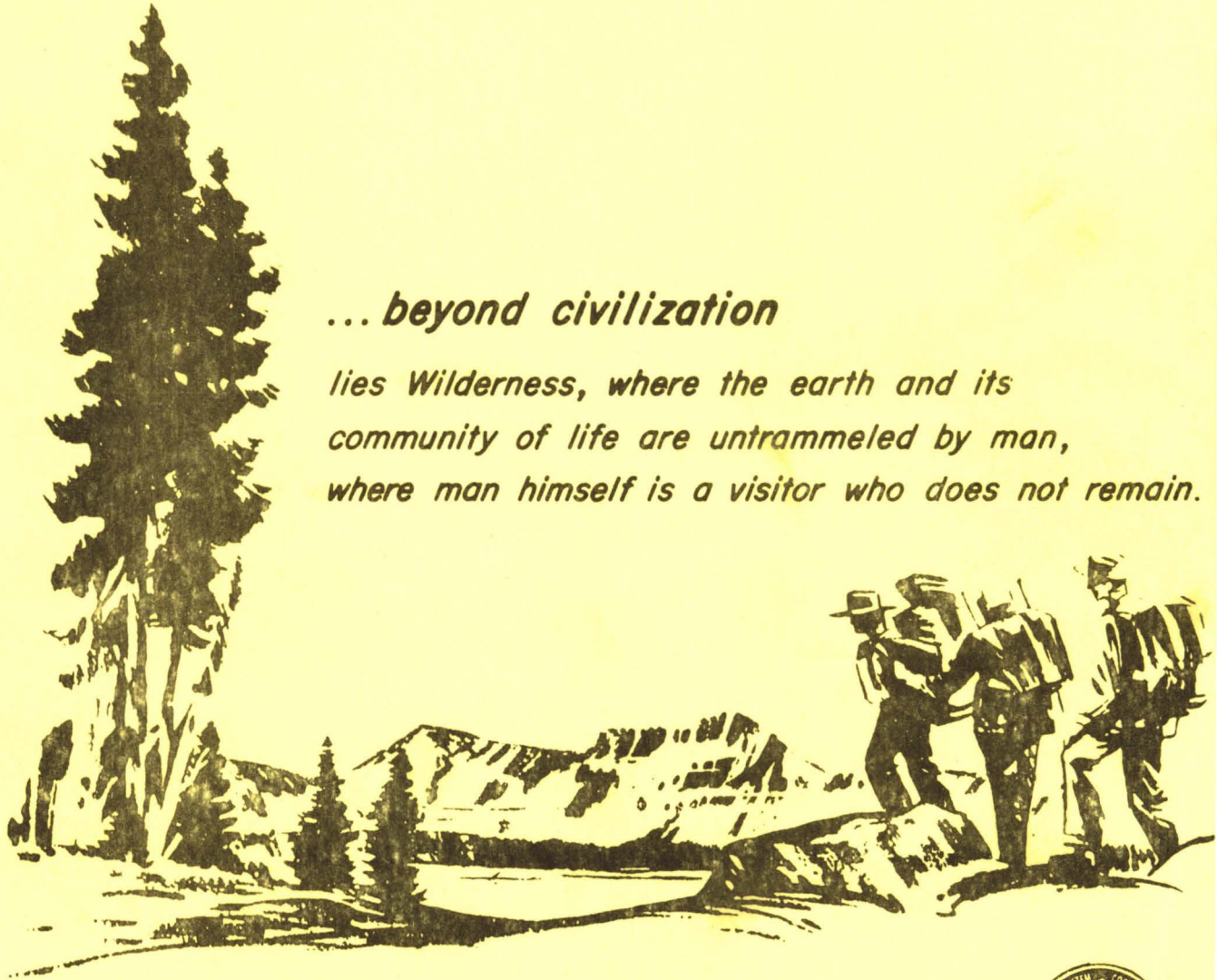
a study plan for determining the

Recreation Carrying Capacity of the Selway-Bitterroot Wilderness

Bitterroot, Clearwater, Lolo and Nezperce National Forests

Montana and Idaho



... beyond civilization

lies Wilderness, where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain.

UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE - NORTHERN REGION

A STUDY PLAN FOR DETERMINING
THE RECREATION CARRYING CAPACITY OF THE
SELWAY-BITTERROOT WILDERNESS

APPROVED BY:

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EXPERIMENT STATION

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I sincerely appreciate all the time and effort each member of this task force has given to complete this plan. A special thanks to Birdie Donica, Shirley Stanhope, and Cam Toavs for typing, proof-reading, and copying this document.

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A STUDY PLAN FOR DETERMINING THE RECREATION CARRYING CAPACITY OF THE SELWAY-BITTERROOT WILDERNESS

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I. INTRODUCTION

A. Background and Purpose

The concept of carrying capacity is basic to wilderness management. Each set of wilderness conditions and experiences wilderness managers seek to provide, implicitly carries some limit in the level of use that can be tolerated. Management actions assure that these limits are not exceeded or correct those situations where they may have been exceeded.

Forest Service Manual 2323.1 provides some direction for estimating recreation carrying capacity: "Consideration must be given to the ability of the wilderness resource to sustain visitor use without loss or degradation of the wilderness resource itself. Capacity may vary widely between kinds of visitors, mode of travel, length of stay, kind of wilderness, and season of use. The wilderness management plan will consider these factors and set guidelines for managing visitor use."

At the time the current Selway-Bitterroot Management Plan was formulated, managers did not have the necessary data on hand to prescribe a recreation carrying capacity. They were unwilling to delay development of a management plan while this data was collected. However, the need for such data was recognized and specific direction given in the plan as follows:

"Form a task force with one represenative from each Forest to prepare a plan for determining a carrying capacity for the Selway-Bitterroot Wilderness. This group will accomplish the following:

-Assemble and study available research

-Consult research people

-Identify data collection needs, methods, and standards

-Develop a flow chart with a schedule of events, assignment of responsibilities, and estimate of manpower needs.

-Complete the draft study plan by April 1, 1977. (This was later adjusted to April 1, 1978)."

The draft study plan was completed by August, 1978 and was reviewed by all Selway-Bitterroot managers and many other wilderness managers and research scientists. Many excellent comments were received and incorporated into this final study plan.

The overall goal of this study plan is to bring out the information necessary to revise and improve the Wilderness Management Plan; scheduled for revision in the early 1980's. The Wilderness Management Plan will incorporate the findings of this study and will specify a series of objectives that will represent the conditions managers are trying to provide. It will also outline the management actions which will be taken to meet these objectives. An array of viable wilderness management objectives and actions will be identified and evaluated through the public involvement process. This study plan also outlines what data needs to be collected in order that a carrying capacity can be formulated.

B. Definition of Carrying Capacity

There are many sources of impact that alter wilderness conditions. These include such things as mining, commercial livestock grazing, water resource development, etc. However, the primary source of most impacts that are of concern to managers derive from recreation use. Thus, in our plan to develop carrying capacity guidelines for the Selway-Bitterroot Wilderness, we will limit ourselves to recreation use and its related impacts. We define carrying capacity as "the recreational use (amount of use, kind of use, timing, distribution, and behavior) consistent with the physical/biological, and social conditions specified by an area's management objectives." Carrying capacity represents a profile of physical/biological and social conditions that we would like to achieve in the Selway-Bitterroot Wilderness. Carrying capacity is exceeded when these specified conditions are exceeded.

C. What Do We Know About Carrying Capacity

A large number of studies have been conducted on various aspects of the carrying capacity problem. An overall summary of the literature can be found in the Appendix. A brief overview of the state of the art follows.

1. Physical/Biological Impact

Most studies suggest a curvilinear relationship between use and impact, with relatively low levels of use producing fairly substantial amounts of impact. For example, at a new campsite, much of the ground cover lost probably occurs under light levels of use, followed by a period of relative stability. Recover times are generally long.

Impact is generally localized along trails, at campsites, and at attractions. Use level is a poor way of estimating impact, with such things as timing of use and type of use much more helpful.

Data are limited on the effects of use on water quality and wildlife. There is some speculation, backed by limited data, that water quality is not a particularly sensitive indicator of overuse. Generally, it is believed that other factors of the environment would reflect overuse before water quality would. Impacts of backcountry recreation use on wildlife are even more poorly understood, and while there have been reports of conflicts (e.g., disturbance of big horn sheep), no firm research is available on the topic.

2. Social Impacts

The level of use can also affect the nature of the wilderness experience and thus lead to a situation in excess of an area's carrying capacity. In summary, the research on this issue suggests that, like the ecological problem, use level is a necessary but not sufficient variable to explain impact. Although reported satisfaction declines with increasing levels of contact, variables such as party size, method of travel, and behavior seem more important.

There are serious conflicts between backpackers and horseback users. Evidence of previous use (litter, campsite impacts) is frequently cited as a major source of dissatisfaction. Perhaps one of the most serious problems stems from styles of use perceived as inappropriate such as loud boisterous behavior. There clearly are norms or rules as to what constitutes appropriate wilderness activity and when these rules are broken, they result in a loss of satisfaction for many visitors. Thus, management actions that facilitate relatively low levels of inter-party contact (e.g., dispersing use in space or time), reducing contacts between potentially conflicting groups (e.g., by letting backpackers know where stock use is concentrated or by limiting party size), and promote appropriate wilderness behavior (e.g., programs that emphasize a wilderness ethic) can all help social carrying capacity from being exceeded.

II. THE PROCESS

We recommend establishing a recreation carrying capacity in the following manner:

A. COLLECT DATA AND ASSESS CURRENT SITUATION. - This takes place at all stages of the process. Some data is needed to delineate management units and define management objectives. Detailed information concerning the current physical/biological and social situations is needed as a baseline for determining management action. Data collection again enters in monitoring the effectiveness of management actions.

B. DELINEATE MANAGEMENT UNITS. - The units must be homogenous, readily identifiable, and the rationale for their establishment must be clear to in-Service personnel and the public.

C. ASSIGN DYNAMIC MANAGEMENT OBJECTIVES. - These will provide the basic description of the conditions which wilderness managers wish to see in each unit. Included as part of the objectives will be standards which specifically quantify the physical/biological and social conditions desirable.

D. ESTABLISH MANAGEMENT ACTIONS. - To direct and change recreational impact to meet the mangement objectives.

E. REVISE THE WILDERNESS MANAGEMENT PLAN AND MONITOR. - Insert management objectives, management actions, and monitoring standards into the revision of the Wilderness Management Plan on a scheduled basis and as needed. Monitor management actions to measure their effectiveness, timeliness, and how they meet management objectives.

Each of these steps will now be discussed in more detail.

A. DATA COLLECTION AND ASSESSMENT OF CURRENT SITUATION

The Selway-Bitterroot Wilderness Management Plan gives us direction to establish a recreation carrying capacity for this wilderness. The implemented capacity will eventually influence and control the amount of use and activities permitted within this wilderness. The management plan also contains other specific resource management direction and decisions. Many of these management decisions currently in effect may require change as a result of the carrying capacity study. As an example, once a capacity is established via a revised wilderness management plan, the transportation system will be planned and altered accordingly. The visitor use capacity must also be considered in making a decision to permit what amount of outfitter-guide services and determine public need.

The following instructions are designed to have all involved managers define, collect, and apply inventory data in a similar manner.

1. Physical/Biological

Within the confines of physical and biological carrying capacity are many factors which are recognized as important to understanding and determining a realistic recreation carrying capacity. Some of these factors are easily discovered and measured and others are much more elusive.

The following material is the task force's best recommendation for inventory standards of physical/biological data. We may find that some standards must be adjusted after this study plan has been agreed upon and adopted. Remember, we are not after a complete inventory of all these resources but enough to determine the recreational impact on them or their effect on recreational use.

a. Vegetation and Soil

(1) Campsite Inventories - Use the Code-A-Site procedure modified for wilderness use as outlined in the May 16, 1977 (2320) letter issued by the Moose Creek RD, Nezperce NF. (The detailed procedure is included in the Appendix).

Stage I should be completed for every known public and commercial campsite in the wilderness. Stages II and III should be done on a case-by-case basis on sites where damage has occurred or is likely to occur.

We recognize that at some future time managers may need a total inventory of campsite categories (i.e., currently used and unused). We do not recommend a total inventory at this time.

(2) Threatened and Endangered Plants - Map all known locations of listed threatened and endangered plants.

b. Transportation System - The transportation system providing access to and within a wilderness is most crucial to the visitor capacity and to managing within that capacity.

(1) Trails

(a) On each District and for each trail, complete Region One Trail Evaluation Form entitled "Trail Evaluation Worksheet, Inventory and Classification (present situation)." (A copy of the form and its' instructions are in the Appendix).

(b) Put all trails on a 1" to the mile contour transportation map, identifying them as mainline, secondary, or primitive routes.

(2) Bridges and Fords

(a) Keep bridge inventory updated on National Forest Development Transportation Plan (Form 7700-M10) and put them on the 1" to the mile transportation map.

(b) Inventory all fords that might be a factor in limiting access during certain seasons of the year or to certain types of users. Record what seasons of the year the ford is useable and by what class of user. Put these on the 1" to the mile transportation map.

(3) Trailheads

(a) Outside Wilderness:
Determine and record the number and location of each trailhead serving the wilderness. Classify each by the following use volumes:

Light - 30 visitors per season
Medium - 30-300 visitors per season
Heavy - 300-1500 visitors per season
Extra Heavy - 1,500+ visitors per season

These volumes are the same as National Trail Assessment criteria.

(b) Inside Wilderness:
Airfields and private guest ranches use same criteria as above. Indicate if a wilderness visitor information bulletin board and/or a visitor registration box exists at each trailhead.

c. Water Quality

Little is actually known about the impact upon wildland water quality due to recreational use. The major concern over recreational use of water is based upon sanitation. Research and management experience

to date indicates that other physical resources such as vegetation or soil will be heavily degraded by recreational use before water quality is. We are concerned with water quality, and as the plan indicates, intend to prevent water contamination by human or stock sources. Our long-range water quality inventory objective is:

To determine if bacterial densities increase in water where recreational user concentrations increase.

Our short-range objective is to establish baseline water quality utilizing the Intermountain Forest and Range Experiment Station's Water Quality Benchmark System. This system under research is being tested in the Northern Region. One test area is the Anaconda-Pintler Wilderness where data transfer to the Selway-Bitterroot may be possible. Water quality monitoring now being conducted outside wilderness on wilderness-originating streams will help to establish benchmarks.

The task force recommends that no specific management inventory standards be set up now to measure water quality in relation to recreation carrying capacity. We believe our efforts (within limited funds) should be directed at other physical/biological/social inventory needs.

d. Air Quality and Visibility

Air quality and visibility goals have been established for the Selway-Bitterroot Wilderness according to the requirements of the 1963 Clean Air Act (Public Law 88-206 as amended through 1974) and the Clean Air Act amendments of 1977 (Public Law 95-95).

Air Quality Goals

Public Law (95-95), designated the Selway-Bitterroot as a mandatory Class I area. Class I established specific maximum allowable increases over baseline quantities of the following two pollutants: Sulfur dioxide and particulate matter.

Standards for other pollutants are still being established by the States.

Visibility Goals

Public Law (95-95) requires the Environmental Protection Agency to establish visibility goals for mandatory Class I areas. This process is still in progress. The Chief of the Forest Service has recommended the following visibility goal for all mandatory Class I areas in the Western States:

"Maintain or improve the present quality of visibility within mandatory Class I Federal areas on a best-day basis (the day of least natural impairment) so that:

1. Man-made air pollution from one or a combination of major stationary sources will not reduce a normal person's ability (with correctable 20/20 eyesight) to clearly distinguish form, line, color, and texture of the landscape of the Class I area at a distance of 5 miles from any point within the area, and;

2. If color and texture can be clearly distinguished for 5 miles within a Class I area, there usually is a visibility benefit looking out of the area. Generally, it should be possible to distinguish form and line at a distance of 50 miles."

Management direction, inventory needs, etc., to meet these goals will be addressed further in the revision of the management plan and are being handled now through letter direction. For example, we are required now to make a baseline photographic record of key vistas within the wilderness.

The amount of air pollution or visibility impairment caused by recreational use of the wilderness is too small to consider inventorying or measuring at this time. The task force recommends that we continue to work on the goals (as above) but do not begin a detailed inventory of air quality in relation to recreational use now.

e. Wildlife

Although wildlife comprises an integral part of the wilderness, very little systematic research has been devoted to the impacts of wilderness recreational use upon animal numbers, distribution, and behavior. We generally lack the ability to predict, in quantitative terms, the consequences of alternative levels, types, and patterns of recreational use on the wildlife species. Inventory standards recommended are:

(1) Report known threatened and endangered species and map their habitat ranges within each unit.

(2) Report and map any known wildlife/recreation livestock or wildlife/recreation user conflict areas.

f. Fish

Inventory standards recommended are:

(1) Rivers and Streams

Record and map rivers and streams containing fish. List species present and relative abundance.

(2) Lakes

Record and map lakes by name and location. Answer the following on each lake:

(a) Are fish present?

(b) What species?

(c) Native or exotic?

(d) Is the population reproducing naturally or is periodic stocking necessary?

(e) Was lake stocked prior to 1964?

(f) If fish are present - Has the lake been stocked? Prior to 1964? Will it support fish?

Wildlife and fish data should be gathered in cooperation with the State Fish and Game Departments.

g. Recreation Stock Grazing

The Selway-Bitterroot Wilderness does not contain any active domestic stock-grazing allotments. Our concerns, therefore, focus on recreation stock. Many outfitter permits include some grazing allocation. A significant portion of the wilderness recreation use, especially in the fall, involves pack and saddle stock.

Our objective in this phase of inventory is to determine how much stock grazing can take place and be consistent with our management objectives. We are thus concerned with: (1) range location and distribution, (2) condition and trend, (3) forage production, (4) utilization, (5) suitability for grazing, (a product of slope, soils, etc.), and (6) conflicts with wildlife in other recreational pursuits. We are not concerned with range that is inaccessible to recreation stock.

FSM 2323.2 provides a policy framework for wilderness grazing management. The Range Environmental Analysis Handbook (FSH 2209.21) outlines standard procedures for range inventory. Most of these procedures are suitable for our purpose. Some however, are not; these include such techniques as: establishment of permanent condition and trend transect with metal stakes and permanent reference markers, and the use of exclosures for utilization measurements. Other suitable methods are available and described in the handbook.

The recommended standard forage inventory procedure and forms are included in the Appendix of this plan. These provide the minimum information necessary for our carrying capacity study. They can be completed by personnel with a minimum of specialized training. More intensive inventory may be completed on special problem areas if necessary, but the standardized forms must be completed for all usable range areas accessible to recreation stock as a minimum.

Each District Ranger should assemble a forage area map for his unit showing general vegetation type, condition, and trend. A 1" = 1 mile base map is suggested. This will be a composite of the sketch maps and/or photo overlays developed in conjunction with the inventory forms.

2. Social

Several categories of social data are needed to develop recreational carrying capacity guidelines for the Selway-Bitterroot Wilderness:

a. Cultural and Historical Resources

Use existing cultural resource inventories. Continue gathering historical information through taped interviews, cataloguing and rephotographing historic photos, copying and cataloguing diaries, personal accounts, letters, etc., and map locations that may effect recreation use.

b. Historical Use Records

In order to determine trends in use, including amounts, type, and distribution in space and time, records of past use should be assembled. These data should be obtained from trail registration boxes, from other administrative records, from the estimates of wilderness rangers, or at last resort, from "best guesses." Categorize the data by trailhead and mangement units if possible, but records for an entire District will be satisfactory. If derived from trail registration boxes, estimated compliance should be supplied.

c. Current Use Patterns

(1) Trails

Estimate (trail registration box, best estimates) current levels of use on the area trails. Break data down by method of travel and by summer, fall, and winter use periods.

(a) Indicate if a current standard wilderness entrance sign exists near the boundary on each trail entering the wilderness. (See FSH 52.81, #1).

(b) Indicate if each trail entering the wilderness has posted on the wilderness boundary/trail intersection

Wilderness Boundary Marker No. 27-6a. (Aluminum metal, gray and black). (See FSH 52.81, #4).

(2) Campsites

To the extent possible collect data on campsite occupancy. Determine which campsites are used and how many nights various campsites are occupied.

d. Characteristics of Use

To the extent possible, data about the character of use should be collected. While direct questioning of visitors is limited by OMB regulations, certain data can be collected through observation. This would include:

(1) Party size
(2) Method of travel (if not available under c. above).
(3) Distribution by trailhead and by use season
(4) Length of stay
(5) Trip itinerary

(This might require direct questioning, but rough estimates of major travel routes, destinations, points of attraction could be inferred through observation by wilderness rangers).

e. Commercial Use

To the extent possible, collect data that pertains to the commercial recreation service day use. In the absence of firm data you are encouraged to estimate the necessary information. Please identify that data which is derived from your opinion and not fact.

Organize the data in the same order as shown in d. above [(1) party size, (2) method of travel, etc.]. Also place the data into the following activity categories (required by management direction 2(e), page 48 of the Selway-Bitterroot Management Plan).

(1) Backpacking
(2) Photography
(3) Trail riding
(4) Ski touring
(5) Mountain climbing
(6) Fishing
(7) Hunting
(8) Other - activities becoming popular enough to generate special use requests.

The analysis of commercial outfitter operations required by the plan will be done in conjunction with this carrying capacity study. Data on the topics listed to consider in this analysis is being gathered through this study.

3. Administrative Activities

Administrative activities may affect recreational carrying capacity of the Selway-Bitterroot. No one is certain yet what share of the physical/biological or social impacts are attributed to administrative travel. This would include the activities we permit other governmental agencies to perform and research opportunities approved for academic and scientific reasons.

Try to quantify, a., the number of visits and visitor days of administration by activity types and b., the AUM's of grazing performed on your District. In the event of overlap projects, such as NURE or USGS mapping, consult with your neighbor to insure against a loss or duplication of information.

The following list is not inclusive, but does represent the major administrative activities that occur in wilderness:

Lookouts, trail crews, wilderness rangers, District Ranger and Staff service inspection, SO/RO/WO service inspection, fish and wildlife habitat studies, inventories, etc., contract obligations, permittees (range, cabins, prospecting and mining, water storage and transmission), research (Government and non-Government), fire management (includes all phases), other agencies (snow, water, minerals, communications, weather, wildlife), and volunteer program activities (YCC, YACC, etc.).

B. MANAGEMENT UNIT DELINEATION

After we quantified criteria and methods for delineating management units, it became obvious that management unit delineation should be based on a combination of a measure of the area's susceptibility to physical/biological impacts caused by human use and some index of the amount of use. An analysis of alternative methods of management unit delineation is in the Appendix.

Using a 1" = 1 mile topographic map, divide the wilderness area into management units. Each management unit will fall into one of the following tentative categories which seem logical at the present time. Each will be given a name tied to a geographic feature. Individual units may have special areas within them which must be "pinpointed". These will also be named to segregate them from the surrounding unit. (See sample map).

As more data and experience is acquired, the units may be more clearly defined.

Category I

These are areas which receive heavy use at the present time and are suffering recognizably lasting damage to vegetation and soil. Heavy use is 300+ visitors per season. (This is the same use classification as used on trail inventories).

These units are most likely to contain primary portal areas, airstrips, fishing lakes, floatable rivers, primary travel corridors, heavy use outfitter camps, other attractions, etc.

Category II

These are areas which receive heavy use at the present time, but are not susceptible to recognizable and lasting damage to vegetation and soil. An example of this category might be an easily accessible travel corridor to a high mountain lake which is located on a bare ridge or a very hardy landtype.

Category III

These are areas which do not receive heavy use at the present time, but the majority of the area is susceptible to damage with an increase in use. It must be recognized that there may be small, isolated areas within the unit which are, in fact, not susceptible to damage.

An example of this category might be a moist, cedar bottom which at the present time does not have ready access but with established access would become very susceptible to damage. Other examples

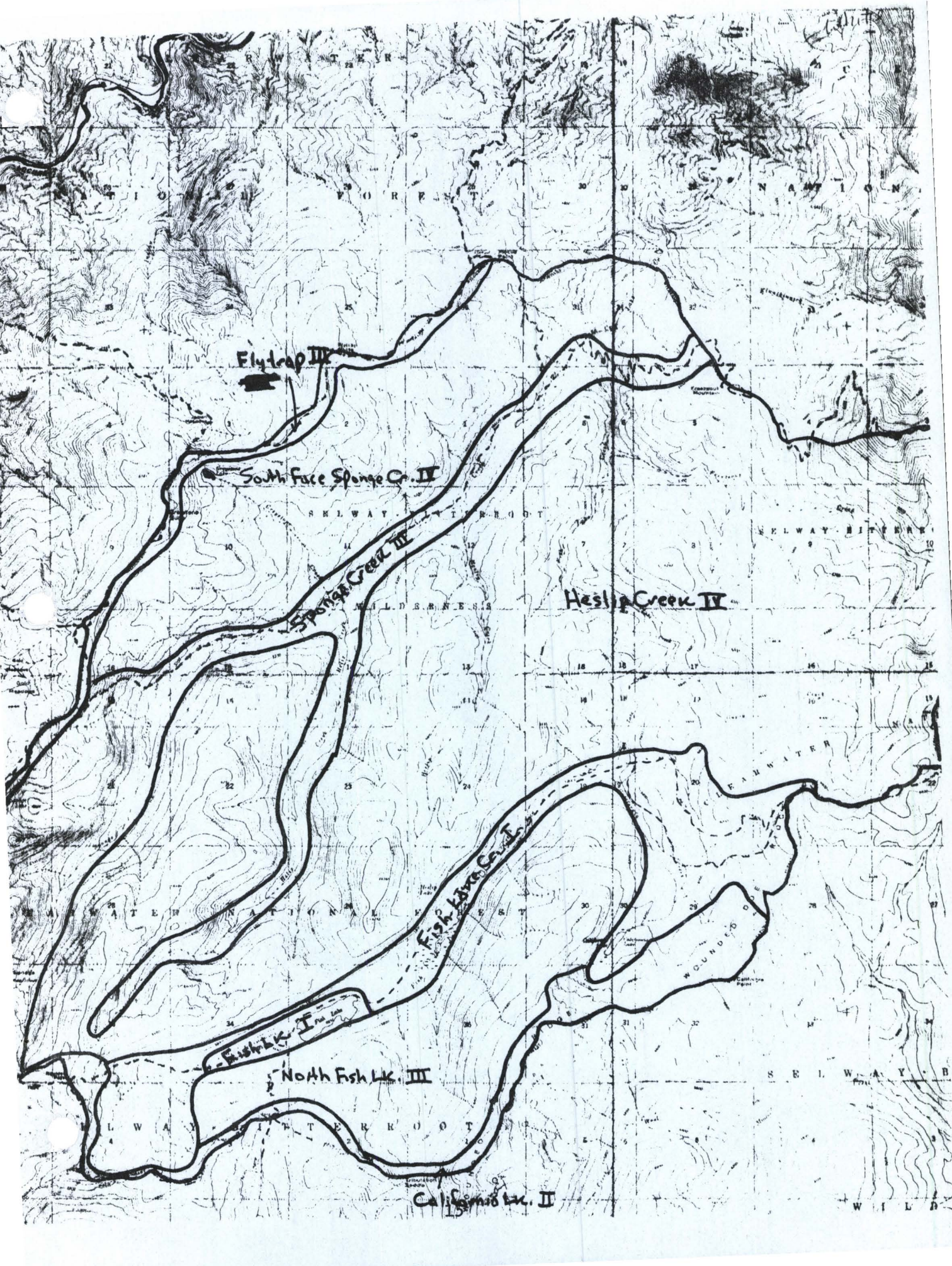
could be critical wildlife habitat not presently impacted or an area adjacent to an outside management unit in which a new road is being built close to the wilderness.

Category IV

These are areas which do not receive heavy use at the present time and are generally not susceptible to damage with an increase in use. It must be recognized that there may be small, isolated areas within the unit which are susceptible to damage.

An example might be steep, stable, north and east-facing slopes with no trails and little probability of use.

The accompanying map of management units delineated on the Powell District will serve as an example of management unit delination. Herb Spradlin and Ed Bloedel, members of the Carrying Capacity Task Force, will meet with each District and assist them in management unit delineation.


Flytrap III
South Face Sponge Cr. II
Sponge Creek III
Hesla Creek IV
Fish Lake Cr. I
Fish Lk. I
North Fish Lk. III
California Lk. II
SELWAY-BITTERROOT WILDERNESS
NATIONAL FOREST

C. MANAGEMENT UNIT OBJECTIVES

We recommend that specific management objectives (goals) be written by District Rangers for each delineated management unit. Objectives are in two basic categories: physical/biological and social. These categories are broken into subcategories as shown below.

The impact of recreational visitor use is heavier, or at least more easily identified, on some of these subcategories than on others. We have marked with an asterisk those subcategories where impact is most easily identified.

At least two alternative objectives should be written for each subcategory marked with an asterisk. They will provide for a range of recreation impacts acceptable within wilderness constraints. For example, one should show the highest level of physical/biological change we will accept and another could show a very low level of change. Alternative objectives can also be written for the other subcategories if needed.

The alternative objectives will be brought to the wilderness user along with management unit proposals during the public involvement phase of establishing a recreation carrying capacity. This will be timed directly with the revision of the Selway-Bitterroot Wilderness Management Plan, thereby incorporating objectives directly into the plan. Final management units, management objectives, management actions, and monitoring standards will all be incorporated directly into the revised wilderness management plan. These specific objectives will be within the Department and Chief's established major wilderness management objectives (FSM 2320.2 and Cutler memo to Chief, August 11, 1977).

Some objectives may be the same for more than one unit. Write objectives to cover more than one unit if possible to help keep the plan simple. We will coordinate and bring together these objectives as much as possible for the entire wilderness before taking them to the wilderness users.

The physical/biological resources (subcategories) are:

*Soil	Water	
Air	*Vegetation	*Subcategories where recreational use impact is more easily identified or may have a higher impact.
Wildlife	Fish	

The social subcategories are:

*Contacts between user parties on trails
*Contacts between user parties at campsites
*Number and size of party contacts
Types of parties (hiking/horse)
Entry point facilities
Cultural resources

Use the Management by Objectives (MBO) format to write objectives. Each objective written will clearly state what "acceptable level" of damage to natural wilderness conditions will be allowed within the unit. In other words, the objective sets the "standard of change" we will allow from natural conditions.

The MBO format requires the objective begin with an action verb such as "to", "limit", "allow", "maintain", etc. It must also:

Be specific
Be meaningful
Be measurable
State when it will be done
Be realistic or achievable
Be consistent with higher objectives such as the Selway-Bitterroot Wilderness Plan and the Wilderness Manual, 2320.

The objective will tell "what, when, and how much", but will not tell "how and why." "How" will be answered in the Management Action Section of the Wilderness Management Plan and "why" is answered in the Situation Section.

Here are some sample objectives:

Management Unit I

Soil

Allow exposure of no more than 10 percent bare soil at campsites within 100 feet of all lakes and streams.

Vegetation

Utilization of palatable vegetation by recreation livestock will not exceed 25 percent by weight during growth periods and 40 percent during dormant periods.

No more than 5 percent of the campsites in this unit will exceed the light impact standard; previous ground vegetation intact but growth somewhat retarded. (Impact of previous use standards are outlined in the approved Code-a-Site procedure, Item 21, p. 96, Appendix).

Social

Maintain a maximum inter-party contact level on the trail of no more than five per day.

Maintain a maximum inter-party contact level at campsites of no more than three other camps within sight or sound per night.

To assure visitors will not contact party sizes of more than 20 persons per party more than 95 percent of their visiting time. (Applies to all units).

D. MANAGEMENT ACTIONS

When environmental or social conditions are inconsistent with selected management objectives, some type of management action is necessary. These might include intensified education efforts, use redistribution, site rehabilitation, or actual control of use. Any action taken should be clearly designed to achieve some particular environmental or social condition and be consistent with existing legislation and policy.

Prescribed management actions are an end result of the planning process. For the Selway-Bitterroot Wilderness, they will be incorporated into the revised management plan with full public involvement. Several alternative strategies may be developed to deal with each problem.

One of the most difficult questions that must be addressed at this point is allocation. Carrying capacity studies have dealt with how much and what kind of use is consistent with management objectives. Allocation addresses the question of who gets to use the wilderness and becomes critical when use approaches capacity. The greatest concern seems to lie with the commercial guest vs. noncommercial user allocation. Educational use may also be important.

E. REVISION OF MANAGEMENT PLAN AND MONITORING

Nothing in a wilderness remains static, be it physical, biological, or social. Monitoring provides a measure of how conditions compare with established objectives and standards. It lets managers know when actions should be undertaken and provides a measure of their effectiveness. Were the desired results achieved? If not, some alternative actions may be appropriate or the objectives and standards may have to be revised.

Carrying capacity is not rigid. Management objectives and standards are, of necessity, based on judgment which may or may not prove realistic under the test of time. The management plan must recognize the need for flexibility and allow room for adjustment in response to monitored conditions.

Monitoring includes such actions as collection of visitor data, measuring condition, trend of campsites, and measuring forage utilization, condition, and trend. Monitoring actions, methods, and standards will be specified in the management plan.

III. STEPS AND TIME SCHEDULE TO COMPLETE CARRYING CAPACITY PROCESS AND REVISION OF SELWAY-BITTERROOT WILDERNESS PLAN

1. Draft Recreation Carrying Capacity Study Plan out to all Districts and Forests for review.

   Carrying Capacity Task Force by August 10, 1978.

2. Continue gathering basic field information (inventory) to standards already established.

   District Rangers, Field Season 1978.

3. All comments back to Carrying Capacity Task Force.

   District Rangers by December 1, 1978.

4. Analyze comments and prepare final study plan.

   Task Force by April 1, 1979.

5. Approve final study plan (includes approving of data needs and standards for gathering this data). (Through the mail).

   District Rangers and Forest Supervisors by May 1, 1979.

6. Delineate management units.

   District Rangers by June 1, 1979.

7. Gather basic field information according to study plan standards.

   District Rangers, Field Season 1979.

8. Write proposed mangement objectives.

   District Rangers by November 1, 1979.

9. Managers coordination meeting to agree on proposed units and objectives. (Task Force set meeting).

   Rangers or Representatives by November 15, 1979.

10. Prepare a summary of the impacts on users and management caused by alternative objectives.

    Task Force by November 15, 1979.

11. Proposed units, objectives, and a summary of the impacts of different alternatives taken to wilderness users (public) for input.

Task Force and Rangers by November 30, 1979.

12. Public input completed by February 1, 1980.

13. Analyze public input and prepare final recommended units and objectives.

Task Force by April 1, 1980.

14. Approve units and specific objectives for incorporation into new management plan. (Task Force schedule meeting).

District Rangers and Forest Supervisors by May 1, 1980.

15. Quantify total data needs and adjust schedule to acquire this data during the 1980 field season.

District Rangers and Task Force by June 1, 1980.

16. Gather <u>needed</u> information according to study plan standards.

District Rangers by October 1, 1980.

17. Analyze information and prepare proposed management actions and monitoring and adjustment standards. Revise Selway-Bitterroot Mangement Plan.

District Rangers by November 1, 1980.

18. Managers meeting to agree on proposed management actions and proposed management plan revision.

District Rangers and Forest Supervisors by December 1, 1980.

19. Begin public involvement on the proposed mangement plan revision which includes previously approved objectives and management units.

District Rangers and Task Force by April 1, 1981.

20. Public input back on plan revision by October 1, 1981.

21. Analyze public input and prepare new recommended Selway-Bitterroot Wilderness Management Plan which includes recreation carrying capacity.

Task Force by February 1, 1982.

22. Approval of revised Selway-Bitterroot Wilderness Management Plan.

District Rangers and Forest Supervisors by April 1, 1982.

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WILDERNESS CARRYING CAPACITY RESEARCH SUMMARY

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This is a copy of chapter 9 of the textbook WILDERNESS MANAGEMENT by John C. Hendee, George H. Stankey, and Robert C. Lucas, USDA, publication 1365. The other chapters referred to in this section are chapters of the textbook and are not found in this document.

The chapter is presented as our summary of the literature on Wilderness Carrying Capacity.

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CHAPTER 9

WILDERNESS CARRYING CAPACITY[1/]

INTRODUCTION

In 1975, 15,600 visitor-days of use were reported for the rugged 64,000 acre Absoraka Primitive Area in south-central Montana. In the same year, the Desolation Wilderness in California, just 531 acres smaller received 256,100 visitor-days of use, or nearly 17 times that of the Montana area!

Is the Desolation Wilderness being overused? Or, is the Absoraka Primitive Area being far underutilized? These questions address the perplexing problem of wilderness carrying capacity. In Chapter 7, we advanced, as a fundamental principle of wilderness management, the notion that the preservation of those qualities defining an area as wilderness required a carrying capacity constraint. Our concern is with determining at what point use conditions become inconsistent with the social and environmental qualities generally associated with wilderness and required by the Wilderness Act. The carrying capacity question is one of the most basic problems confronting wilderness managers today. For, theoretically and practically, each set of wilderness conditions and experiences that are sought as management objectives implicitly carry with them some limit in the kinds and amounts of recreation use that can be tolerated as well as the need for various policies and actions to see that these limits of tolerances are not exceeded. In the following chapter, we explore the origins of the carrying capacity concept, consider its application to wilderness, and briefly review what is known about it. In addition, we present a general model of carrying capacity and describe its possible application to wilderness.

1/ The contributions of Dr. Sid Frissell, School of Forestry, University of Montana, are gratefully acknowledged.

As we will discuss in more detail in Chapter 13, wilderness use has grown steadily over the past three decades and, even though annual growth rates may be diminishing somewhat, future increases in absolute numbers are expected. As use grows, so will problems of resource damage and congestion. For instance, the presence of 1,000 people camped in the South Fork Basin of the San Gorgonio Wilderness in Southern California on a single day hardly offers the kind of solitude seemingly called for by the Wilderness Act (Hay 1974). Nor do trails eroded six feet deep by recreational use in the Selway-Bitterroot Wilderness in Montana seem consistent with the notion of an area managed to retain its primeval character (Helgath 1975). Severe resource damage and increasing numbers of people in some wildernesses has led one observer to write an article in the Los Angeles Times entitled "National Wilderness Areas - They exist in name only" (Fradkin 1971).

Some have argued that undesirable impacts could be offset by rapid expansion of the National Wilderness Preservation System, thus making more acres available to the increased numbers of users. Growth of the Wilderness System will, of course, occur and will help absorb some impacts due to increased use. But adding more acres to the system as a solution to the problem of increased use has two important limitations. First, as we discuss in Chapter 6, it is only a short-run solution at best because the amount of acreage suited for wilderness classification is limited. As of December 31, 1976, 14.4 million acres of classified wilderness existed; possibly, the system will expand threefold or fourfold beyond this. But, at some point there will simply be no more land for consideration as wilderness. A second problem is that adding new acres to the Wilderness System does not necessarily increase capacity in a net sense because many of these acres already sustain substantial amounts of wilderness-type use.

Expanding the supply of wilderness as a solution for accommodating increasing use is an important part of the total package of tools available to citizens and resource managers to preserve the resource. But in the face of a limited supply and increasing demand, more attention needs to be devoted to making optimum use of a fixed supply. Intensified management will be required to make the limited wilderness resource yield more benefits, consistent with the constraints and objectives imposed by the Wilderness Act. As we note in Chapter 7, the preservation of wilderness is dependent upon maintaining a balance between supply and demand; a balance achieved through a carrying capacity constraint. Thus, the management concept of carrying capacity becomes increasingly important.

THE CONCEPT OF CARRYING CAPACITY

Carrying capacity, a fundamental concept in natural resource management, is the limitation on use of an area, set by various natural factors of environmental resistance (e.g., food, shelter, or water). Beyond this natural limit, no major increases in the dependent population can occur (Odum 1959). For example, a particular range might be capable of supporting 100 deer. In other words, when 100 deer live on the range, there is a balance between animal numbers and available food, shelter, and water. If that balance is upset, perhaps by a substantial growth in numbers of deer, the productive capabilities of the range suffer. Food resources become depleted and perhaps even destroyed as animals search for nutrition. In such a situation, herd numbers exceed the range's carrying capacity and its ability to maintain deer will decline, even though a temporary increase in population might have occurred. In extreme cases, the imbalance may lead to long-term environmental impacts that are virtually irreversible.

As defined above, carrying capacity is seemingly uncomplicated. In fact, it is not. For instance, our example above involved deer; if the species had been elk or sheep, the numbers of animals capable of being supported on the same range would have been quite different. So, we can see that capacity limits vary according to the type of consumer we are talking about. Also, the limits were those naturally imposed. Had management intervened (e.g., by supplemental feeding or irrigation of natural forage), the range would have been capable of supporting a greater number of animals. Thus, carrying capacity is not an inherent, fixed value of the land. It can be diminished by unregulated overuse or enhanced by thoughtful management.

In recreation management terminology carrying capacity has become a common, if not altogether well understood, term (Chubb and Ashton 1969). Generally, it is used in two different ways. First, it is used to describe the ability of the physical-biological environment to withstand recreation use. Various studies have been made of the impact of use on vegetation and soils (Willard and Marr 1970), water (Barton 1969), and wildlife (Schultz 1975). Second, carrying capacity has been used to express the amount of use that is consistent with some measure of "quality" in the recreational experience (Wagar 1964). Studies of "social carrying capacity" have focused on such things as the impacts of increasing use on the recreational experience (Shelby and Neilson 1975) and on the impacts of conflicts between user groups (Lucas 1964).

Efforts to measure the carrying capacity of recreation lands have been pursued with considerable enthusiasm, at least partially with the belief that once the magical figure was found, the task of recreation management would be made easier (Wagar 1968). But just as carrying capacity is not a simple notion for the range or wildlife manager, neither is it for the recreation manager. Several problems can be noted. For instance, recreation lands are used by many different people ("consumers") seeking many different, and sometimes conflicting, experiences. Some want solitude, others look for companionship, and what is appropriate for one represents congestion or loneliness to another. Thus, theoretically at least, there would be a different carrying capacity for every type of experience provided.

Impacts on physical-biological resources are not precise indicators of overuse, either. Any use of an area produces some change; in fact, studies measuring resource impacts from recreation use generally report that light use produces substantial unnatural change (Frissell and Duncan 1965; Wagar 1964; Merriam et al. 1973). Thus, if a manager elects to allow only use that will produce little or no change, it will be necessary to restrict use at very low levels (Wagar 1968). Finally, capacity, considered from either the biological or the social perspective, is a function of more than simple numbers of users. In fact, use intensity by itself, seems to be a fairly poor predictor of impact (Stankey 1973); variables such as seasonality of use (LaPage 1967) and habitat type (Helgath 1975) are more effective in predicting impacts on the resource while type of use encountered (Lucas 1964; Lime 1975) and the location of encounters (Stankey 1973) are particularly important in assessing impacts on users.

In light of these problems, some have argued that carrying capacity either has little to offer managers or is so complex that it cannot be made operational (Wagar 1974; Bury 1976). In part, these arguments rest on the concern that efforts to determine the "magic number" implied by carrying capacity divert attention from a wide variety of alternative management strategies. This is a very real possiblity and while we have chosen to stick with the term "carrying capacity," it is important that we explicitly define how we view its role in wilderness management.

Definitions of the carrying capacity concept as applied to recreation and wilderness management abound. One recent annotated bibliography listed over 20 articles defining the tern (Stankey and Lime 1973).

We believe a useful definition of carrying capacity in the context of wilderness is its capability to produce wilderness-dependent experiences. Our focus is on the human experience for it is, after all, the ultimate product of all resource management programs (Wagar 1974). While management input can be employed to enhance capacity, it nevertheless must be used sensitively and conservatively, given a ligislative mandate which calls for substantial preservation of the historic ecological processes that shaped the physical-biological community. Those experiences related to enjoying, appreciating and learning about these natural processes deserve emphasis in management as do those that relate to "solitude or a primitive and unconfined type of recreation" as outlined by the Wilderness Act. Thus, wilderness carrying capacity represents those "use configurations"[2/] consistent with the long-term maintenance of opportunities for wilderness-dependent experiences.

2/ Use, which is more than a matter of simple numbers, varies also by type, time, space, and behavior. We use the term "use configuration" to refer to some specific combination of these variables (Frissell and Stankey 1972).

As we mentioned above, the term "carrying capacity" has been criticized as an inappropriate, inadequate, and possibly even misleading concept in recreation and wilderness management. Rather than taking part in the debate surrounding the term, we think it more important to promote understanding of the underlying intent of the concept. If we are to preserve those social and ecological qualities that constitute wilderness, we need to balance use with its associated impact on these qualities. Carrying capacity is the general framework we use to do this.

From this definition, we offer four caveats, or qualifications, that govern the application of carrying capacity to wilderness planning.

The determination of carrying capacity is ultimately a judgmental decision

Perhaps the most fundamental point to be made about carrying capacity is that it is a product of management judgment rather than a precisely defined measure or scientific concept--is a decisionmaking concept rather than a scientific concept. Whether we are measuring physical-biological impact or social impact, the relationships between use and the resultant impact are typically described by continuous curves, which lack abrupt and clearly defined changes (Frissell and Duncan 1965; Wagar 1964; Stankey 1973). Information about use impacts will not define capacity limits; it will describe the consequences associated with differenc use conditions. Such decisions must rest on the judgment of managers as to whether these consequences, either recorded or anticipated, are acceptable.

Such a situation clearly limits the role of the researcher or scientist in the capacity calculation. The researcher, rather than prescribing "how much is too much," is the source of information about the stream of consequences of alternative use configurations on the ecological, physical, and social elements of a setting. From such information, standards can be formulated and criteria prescribed for identifying factors that might limit use (Pfister and Frenkel 1975). As far as possible, these standards should be measurable or quantifiable conditions in order that logical and defensible decisions about use limitations can be made.

Although the establishment of carrying capacity standards should have a base in scientific knowledge, the judgmental nature of the carrying capacity definition still leaves open the possibility of decisions that are arbitrary or illogical. Our second qualification deals with this concern.

Carrying capacity decisions depend on clear management objectives

Management objectives--the definition of the environmental and social conditions that have been chosen to prevail at a specified location--provide the basis from which carrying capacity determinations are made. As Wagar has noted (1974), decisions about objectives involve value choices based on normative judgments of what ought or should be as opposed to technical decisions about what can be. Being value judgments, they are less dependent on the technical expertise of resource management professionals than on their agreement with broad social goals defined as desirable by public consensus.

Only when these goals are reduced to specific area management objectives--formal statements of the environmental and social conditions that management either seeks to maintain or to restore--can logical carrying capacity decisions be made. Statements of management objectives should thus be precise and site specific so they can serve as criteria for making carrying capacity decisions. In Chapter 8, we described the importance of management objectives in planning any wilderness management action and the factors that influence how objectives are formulated. Here we see their integral function in resolving the carrying capacity question.

In making carrying capacity decisions, the range of available alternative opportunities must be taken into account

Decisions about carrying capacity, like similar judgmental decisions, should be considered in the context of a broad spectrum of outdoor recreation and leisure opportunities. Such decisions should be resolved in light of other opportunities existing within a regional area. Only when wilderness is viewed as one part of a broader outdoor opportunity system is there an equitable and defensible rationale for preserving the relatively low density use commonly associated with wilderness. In order to adequately meet the diverse tastes of people, a range of opportunities is needed, varying in terms of such things as interpersonal contact, access, and development (Lloyd and Fischer 1972). Carrying capacity thus represents a general management strategy for maintaining a particular set of conditions within a system of recreational opportunities (Lime and Stankey 1971)--a strategy that is a direct consequence of the decision to preserve a range of different opportunities. But the maintenance of these conditions, particularly where direct limitations on use may have to be implemented, can be justified only if alternative settings meet people's needs for other kinds of experiences. In our view, maintaining carrying capacities for wilderness without providing and managing for other nonwilderness opportunities will be, in the long run, politically unacceptable.

Carrying capacity is a probabilistic concept, not an absolute measure

Our fourth qualification is that carrying capacity can be stated only in terms of what is probable, not in terms of what can be assured. This generalization simply points out that in no way can all the contingencies affecting capacity decisions be predicted or accommodated. The vagaries of weather, changing user behavior, and so forth will always mean that unanticipated impacts will occur. Carrying capacity is not intended to anticipate all such events. Rather, it is intended to serve as a framework that accommodates the most probable pattern of events.

As an example, capacity calculations might be made assuming that normal weather patterns will prevail. However, a sudden spell of unseasonably rainy weather that turned trails into muddy mires, would obviously upset these calculations and force managers to reassess the anticipated impacts of use on these trails. Thus, while the carrying capacity determination for an area serves as a basic outline of the use-impact relationship managers can reasonably expect to occur, it does not eliminate the need for continuous monitoring of conditions or the need for good professional judgment in the face of changing conditions. Establishing carrying capacity standards for an area will not give managers an impersonal formula to which they can turn in order to make difficult decisions (Wagar 1968).

In summary, carrying capacity is ultimately a judgmental determination rather than the product of some absolute and measurable characteristic of the environment. In specifying carrying capacity, we are prescribing the use configuration consistent with the social and ecological conditions we wish to prevail at a location. These conditions are formalized in area management objectives derived from managerial judgment and citizen input, tempered by various constraints, such as laws. Definitions of appropriate capacity levels need to be derived in light of a spectrum of outdoor opportunities in order that diversity and equity be achieved. Finally, capacity is a probabilistic concept; it is neither possible nor necessary that all contingencies be accommodated.

As we discussed above, the role of science in the determination of carrying capacity levels is one of providing information about the probable outcomes, changes, or consequences anticipated from different use configurations. Giving administrators accurate, reliable information on which to base their decisions is a responsibility of the researcher; the decision as to how much change is too much is an administrative responsibility.

ECOLOGICAL RESEARCH ON WILDERNESS CARRYING CAPACITY

Wilderness and other minimally impacted lands have been the setting for a variety of studies of human impact on ecosystems (see Liddle 1975 for a good review). Although more work is needed, some important guidelines have begun to emerge. The following is a review of studies in order to identify the degree to which recreational use alters natural conditions.

IMPACTS ON VEGETATION AND SOIL

Perhaps the most significant conclusion concerns the relationship between increasing use and associated impacts. Several studies (Wagar 1964; Frissell and Duncan 1965; Merriam and Smith 1974) have reported the presence of a curvilinear relationship between use and impact on vegetation and soils, with substantial amounts of impact occurring with only light use. For example, Frissell and Duncan found that over 80 percent of the ground cover was lost at campsites in the Quetico-Superior with only light recreation use. (They defined light use as from 0 to 30 days use per season.) Similarly, in a five-year study of impact on newly opened sites in the Boundary Waters Canoe Area, Merriam and Smith (1974) reported that most site impact occurred within the first two years, then leveled off for the remainder of the study period.

In Olympic National Park, Bell and Bliss (1973) found that cover and productivity changes declined exponentially. On sampled strips of vegetation, total cover declined 59 percent and annual productivity 46 percent with only five applications of treading per day. They noted that the quantity of living plants on a site could be greatly reduced before the effects were particularly noticeable to the casual observer. Based upon this data, they estimated that 80 percent of the plant cover on certain locations could be destroyed in only two weeks, with as few as 50 people per day passing over the area.

It is also clear that different kinds of use produce impacts at different rates and that use level, computed solely as some measure of intensity (e.g., visitor-days), is a poor predictor of impact (LaPage 1967). In an investigation of trail deterioration in the Selway-Bitterroot Wilderness, for example, Helgath (1975) reported that the amount of use on trails was less strongly and consistently related to deterioration than expected. She noted, as others have observed, that much of the impact seemed to occur with only limited use, and she attributed part of this phenomenon to the early loss of vegetation, promoting soil erosion and instability.

In a series of experiments, Dale and Weaver (1974; Weaver and Dale [in press]) have examined the impact of various kinds of recreational users on trails. They found that typically only a relatively narrow band of vegetation is impacted along trail sides. In contrasting the relative impacts of hikers, cyclists, and horses on vegetative cover, trail width, trail depth, and soil compaction, they report the following findings (Weaver and Dale [in press]):

Vegetative cover: (1) Vegetative cover was reduced by trampling; (2) vegetative loss was more rapid on sloping sites than on level sites (also see Helgath 1975); (3) vegetative loss was more rapid in dwarf shrubs than in grassy vegetation; (4) on level ground, impact increased from hiker to cyclist to horse; and (5) on slopes, hikers were less destructive than cyclists or horses.

Trail width: (1) Trail width increases with increased use to some equilibrium width; (2) equilibrium trail widths are wider on sloping sites than on level sites; and (3) on both level and sloping sites, trail width increases from hiker to cycle to horse.

Trail depth: (1) Trail depth increases with increasing use, with possibly no equilibrium depth; (2) depths are greater on slopes than on level sites; (3) depths tend to be greater in stone-free meadow soils than in stony forest soil; and (4) depth increases from hiker to cycle to horse.

Soil compaction: (1) Soil compaction increases with trampling; (2) compaction is greater on slopes than on level sites; and (3) compaction increases from hiker to cyclist to horses.

Weaver and Dale also reported that while cycle damage was greatest when machines moved uphill, hiker and horse damage was greatest traveling downhill, due to the plowing and braking action as the hiker or horse attempts to hold back.

The variable impact of different types of recreation users also was apparent in a study of campsite impact in the Spanish Peaks Primitive Area in Montana by Frissell (n.d.). At campsites predominantly occupied by visitors using stock, an average 42 percent of the campsite surface was devoid of vegetation, organic litter, or humus; at sites used primarily by hikers, about six percent of the cover was gone. In addition, horse party camps averaged about 10 times the impacted area of hiker camps. Using a site condition typology developed in his report, Frissell reported that one-half of the sampled campsites were in a condition of deterioration calling for close management attention.

A major shortcoming of many impact studies is their failure to follow impact over an extended period (Speight 1973). One major exception is a five-year study of visitor impact on newly developed campsites in the Boundary Waters Canoe Area (McCool et al. 1969; Merriam et al. 1973; Merriam and Smith 1974). Using a composite of site conditions to calculate an impact stage for campsites, they found that most new sites reached a maximum level of impact in about two years. Although there was no significant difference in tree growth between on- and off-site trees, this apparently was due to the fact that most root systems had penetrated through the thin soil mantle into underlying rocks and were thus protected from trampling. However, Magill (1970) also reported that growth rates of trees in California campgrounds used for over 30 years did not appear to be affected by recreation use. Soil compaction reached a maximum in about two years and the author's estimates, as well as others (Thorud and Frissell 1969), suggest recovery might take as long as six years.

Merriam and Smith (1974) also reported that, among 21 new campsites studied, 10 expanded 50 percent in size and four expanded over 100 percent. Only one site showed no expansion during the five-year study.

IMPACTS ON WATER QUALITY

Recreation impacts on water quality in backcountry and wilderness areas have not been studied in any detail. Merriam and Smith (1974) noted that coliform bacteria counts were higher near campsites than at control points and that phosphate and turbidity levels were also increased near camps. However, other parameters of water quality (e.g., temperature, dissolved oxygen) were not affected and they concluded that recreational impacts on water quality were generally small.

McFeters (1975) also found little impact on water quality in watersheds sampled in Grand Teton National Park. In fact, he reported that in studies of microflora in the water of two adjacent watersheds near Bozeman, Montana, one open to public use and the other closed to public entry for the past 50 years, the closed watershed produced consistently higher bacterial counts than the open watershed. He attributed the difference to the fact that wild animals contribute significantly to microflora content in water and that the presence of people in the open watershed had disturbed these animals, causing them to move from their natural habitat to new territories within the closed watershed.

IMPACTS ON WILDLIFE

Although wildlife comprises an integral part of the wilderness (see our discussion in Chapter 11), very little systematic research has been devoted to the impacts of wilderness use upon animal numbers, distribution, and behavior (Speight 1973; Stankey and Lime 1973). It is clear that wildlife populations, including the large ungulates and carnivores as well as smaller species of mammals and birds, are affected by backcountry recreation use, particularly when this use is concentrated in critical habitat areas. The potentially fatal consequences of recreational use in grizzly bear habitat is probably the best example of conflict between the backcountry user and wildlife. Research is underway to provide data to minimize visitor intrusion into grizzly habitat (Craighead and Craighead 1971; also see the discussion in Chapter 11).

Recreation impacts upon wildlife are probably particularly significant where the species has a limited habitat in which it can survive and/or a habitat that is attractive to recreationists. However, our knowledge of these impacts is limited. Although typical wilderness uses, such as backpacking, probably have a fairly brief and relatively minor impact on wildlife, increases in this use will increase the level of harassment on wildlife populations (harassment is defined as any activity of man and his associated domestic animals which increases the physiological costs of survival or decreases the probability of successful reproduction) (Neil et al. 1975).

In summary, our understanding of the ecological consequences of backcountry and wilderness use is limited. What information we do have is generally descriptive in nature. We generally lack the ability to predict, in quantitative terms, the consequences of alternative levels, types, and patterns of use on the physical-biological environment, a serious shortcoming in our efforts to develop the potential of the carrying capacity concept.

Physical-biological impact is a complex phenomena. It does not bear a a direct linear relationship to use; in fact, use intensity is less helpful than other variables (e.g., method of travel, season of use) in explaining the degree of impact sustained. With the onset of recreation impact, substantial alterations in vegetation and soil occur, generally followed by a state of equilibrium. At this equilibrium point, there is typically a major shift in the composition of the vegetation, with delicate and fragile species disappearing, to be replaced by hardier, more resistant species (Verburg 1974). Thus, ecosystems can adapt to recreation pressures through a process of succession. However, while this kind of adaptation could aid managers of developed campgrounds (e.g., see Magill 1970 and Merriam and Smith 1974) such succession is a major problem in wilderness where a key management objective is the preservation of natural conditions. We will return to this issue shortly.

For the purposes of our discussion, the key point is that recreation impacts on ecosystems can lead to a departure from naturalness along a number of specific dimensions: the level of vegetation loss and its subsequent replacement by non-native species; soil erosion and compaction; water quality impacts; and impacts on wildlife behavior and population levels. Such departures, then, represent conditions where carrying capacity constraints may have to be imposed to prevent an unacceptable loss in wilderness quality.

SOCIAL RESEARCH ON WILDERNESS CARRYING CAPACITY

Concerns about use impacts are not limited to changes in the physical-biological environment; there is also concern about how use affects the quality of the visitor's experience. If we define wilderness carrying capacity as representing those conditions conducive to wilderness-dependent experiences, we can cite a number of studies that provide information on how varying use conditions impact visitor experiences.

USE LEVELS AND TYPE OF GROUP

Several studies have reported that visitors prefer relatively few encounters with other parties, a preference consistent with the importance of solitude as a management objective in wilderness. Lucas (1964) found that canoeists in the Boundary Waters Canoe Area preferred much lower use levels than did motorboaters. He also noted that canoeists perceived two critical levels of use intensity--one where anyone was met and the second, at a point where between six and 10 groups were seen in a day. In terms of preferred types of encounter, canoeists indicated they could accommodate seeing anywhere from zero to five canoeists, but they preferred no contact at all with motorboaters.

Lucas' study points out an important finding reported in several other investigations; the impact of use intensity or use level is extremely difficult to dissociate from the <u>type</u> of use involved. The level of use people report as preferred or tolerable is not independent of the type of use involved. We will see this relationship in other studies reported below.

Lime (1975) has also studied use in the BWCA and his work corroborates that of Lucas' and earlier studies. Although use in the BWCA is heavy, it is also highly variable in both space and time. Lime found that some visitors encountered 40 times as many users as did other visitors, even though only a short distance separated the two groups. Nearly three-fourths of the canoeists reported they saw too many others on at least one day of their trip; typically, about three encounters per day was considered the maximum level of contact before the sense of being in the wilderness was impaired. As Lucas discovered, however, most canoeists (90 percent) preferred to meet no motorboaters.

In a study of capacity perception by wilderness visitors in four areas, Stankey (1973) found a declining level of preference for increased levels of use contact. For example, while about 75 percent of the visitors to three western areas (the Bob Marshall Wilderness in Montana, the Bridger Wilderness in Wyoming, and the High Uintas Primitive Area in Utah) indicated that having no contact with backpackers was a pleasant experience, only 20 percent felt the same about four encounters. Although a lower level of preference was expressed for contacts with horse parties, the difference was not great.

Unlike backpackers, canoeists in the BWCA seem to prefer a low level of contact with other canoeists to none at all. About one-half of them indicated a preference for contact with no other canoeists, and about two-thirds preferred two encounters. However, for two contacts with motorboats, it declined quickly to 20 percent.

Following the methodology used by Stankey, Badger (1975) studied crowding problems in the Rawah Wilderness in Colorado. Most visitors (67 percent) felt that the amount of use encountered was "about right," while the remaining one-third thought it was "too crowded." Badger also examined the levels of use people desired (preferred) to encounter as well as the amount they would tolerate (put up with). In general, about a 1:2 ratio existed between the two measures; i.e., they preferred a level of contact only about one-half of that they would tolerate. Additionally, tolerance for increasing use levels was greater when the contact involved hikers rather than horse users.

The idea that the quality of the wilderness experience automatically declines with increasing use levels is not altogether accurate however. Stankey (1973) reported that users generally prefer encounter levels of one or two other groups to a zero level of contact. Pfister and Frenkel (1974) report a similar finding among visitors on the Rogue River in Oregon, with half again as many persons preferring one contact to zero contact. At least a minimum opportunity for socialization and interaction with others seems important even for wilderness visitors.

However, higher than preferred contact levels do not necessarily detract from the wilderness experience. Shelby and Neilsen (1975) found that measures of overall trip quality were unrelated to actual river contact level among visitors on the Colorado River in the Grand Canyon. Nor did they find any significant relationship between perceived crowding and reports of satisfaction.

Like physical-biological impact, the impact of use on the wilderness experience is a complex phenomenon. As the discussion above indicates, the amount of use one encounters can alter the experience, but the relationship is not necessarily linear. The kind of use contacted is clearly one variable that must be specified. However, another important factor is where the encounters occur. Stankey (1973) found that reactions to encounters along the periphery of the wilderness differed in their impact on users from those occurring in the interior. The impact of those occurring along the outer edges of the wilderness was apparently tempered by the expectation of most visitors to meet other people in this area. Once in the interior, however, where expectations were for low contact, encounters had a subsequently greater impact. Impacts from encounters also varied according to whether they occurred along the trail or at the campsite, with the latter being more stressful.

Badger (1975) also examined the effect of encounter location and found similar results. Most visitors showed greater tolerance for encounters near the trailhead than near their destination and for encounters along the trail rather than at the campsite. He also found greater tolerance for groups camped further away than for those nearby.

The importance of relative solitude at the campsite has been hypothesized as a possible "bottleneck" on overnight capacity (Hendee, 1967; Stankey 1973; Badger 1975). Dunwiddie and Heberlein (1975) found strong and consistent support for such an hypothesis. In an observational study of actual campsite selection behavior in the Bridger Wilderness in Wyoming, they found that experienced visitors distinguished themselves from novices by selecting campsites that were 1) further from other visitors; 2) further from the nearest campsite, whether it was occupied or not; and 3) in an area with few other sites. Knowledgeable visitors were more likely to spread themselves out from all other parties. The authors also concluded that beyond certain density levels, the more experienced visitors were "crowded out."

Another important characteristic of use that seems to have a significant effect on visitor experiences is group size. Although large parties typically comprise only a small percentage of total use (e.g., in the Boundary Waters Canoe Area, groups of more than 10 people comprise only five percent of the total use [Lime 1972 and see Chapter 13]), they may have a disproportionate impact on both the wilderness resource and the wilderness experience of others they encounter. Most users studied have reported a preference for small, rather than large, groups. Definitions of "small" and "large" vary from study to study, but generally parties of less than 10 to 12 persons are perceived as small. Stankey (1973) found that users generally preferred contacts with small rather than large groups, even when given a choice between meeting only one large party per day as opposed to 10 small parties per day. Pfister and Frenkel (1974) also found similar results. Most users felt that seeing large parties reduced the feeling of being in a wild river area, although persons in large groups tended to be more tolerant of other large groups. Badger's work in the Rawah Wilderness (1975) also confirmed visitor preference for smaller groups.

Because most visitors travel in small groups, parties that violate the small-party norm probably seem more conspicuous and the individuals making up such groups might be perceived as different from most visitors. Such perceptions might stem from concerns about resource impact, crowding, or simply the feeling that such groups are inappropriate in a wilderness setting (Stankey 1973). Whatever the reason, the fact that members of small groups do not readily identify with members of large groups is an important finding, especially in view of the work of Lee (1975) who reported that the expressed satisfaction of trail users in the Yosemite National Park backcountry depended in part on the extent to which visitors perceived one another as being similar.

VISITOR BEHAVIOR

In determining the impact of use on the wilderness experience the behavior of persons might be more significant than are such things as total use, party size, and travel methods used by groups encountered. Lee (1975) found that both along the trail and at the campsite, important influences on visitor satisfaction were the demeanor, friendliness, and courtesy of peopley they met. Many of the potential conflicts between user groups probably can be mitigated if visitors abide by accepted norms of wilderness behavior. For example, selecting a campsite out of sight and hearing of another occupied camp respects the privacy and solitude many users seek and lessens the prospect of conflicts between visitors. Guidelines from research on campsite spacing to avoid unnecessary noise intrusions have been developed that allow managers to help reduce such conflicts (Daily and Redmond 1975.)

The physical evidence of inappropriate or illegal behavior is also a serious impact on the wilderness experience. Probably the best example is littering. Stankey (1973) found that virtually all persons sampled in four wildernesses objected to the presence of litter. Additionally, most felt that a littered campsite represented a more disturbing condition than seeing too many people.

Badger (1975) reported that inappropriate behavior was overwhelmingly more disturbing than a less-than-desired distance between one's own campsite and another. People were also more disturbed by seeing litter or other environmental damage than they were by seeing other people or experiencing conflicts because of travel methods, group size, or the location of the encounter.

In the Yosemite National Park backcountry, Lee (1975) also reported that visitor satisfaction was related to the absence of litter on trails and at campsites. He noted that the presence of "unnatural" objects left by previous visitors (e.g., makeshift tables) was more disturbing to visitors than deterioration of the immediate physical environment.

In summary, then, a variety of use-related variables must be examined in order to accurately measure the consequences of use on the wilderness experience. While increasing use is clearly one of the important variables, other parameters of use must also be examined and may be more significant than total use. As was the case with ecological impact, use intensity is best described as a necessary, but not sufficient variable, in the determination of the social impact of wilderness use. Violations of acceptable behavior and conflicts over appropriate styles and methods of use often will be the critical variables on which managers must focus their attention. As Lee (1975) notes, social relations between wilderness campers were more important to the satisfaction of those users than was the condition of the physical environment. Therefore, encouraging appropriate wilderness behavior might be the most important action managers can undertake.

The research on visitor perceptions of crowding and overuse must be carefully interpreted. Much of the research on the effects of increasing use on visitor satisfaction has involved hypothetical situations and questions of preferred, rather than actual, contact. Studies reporting responses to use levels actually encountered have generally reported little association between the level of contact and visitor satisfaction. This work has been done in a variety of wildland settings; Lee (1977) in the Yosemite National Park backcountry, Shelby and Neilson (1975) on the Grand Canyon of the Colorado, Heberlein (1977) on the Brule River in Wisconsin, and Lucas (1977) in the Desolation Wilderness. Each of these investigators has found little statistical or substantive relationship between the amount of use visitors actually encountered and the level of satisfaction they reported with their experience. Does this mean that solitude is not important in wilderness?

In response to this rhetorical question, we would say no. First, the Wilderness Acts specifically call for wilderness management to offer opportunities for solitude. But perhaps more importantly, the lack of an observed relationship between use and satisfaction has several potential explanations, not necessarily exclusive of one another. The level of contact with other people is only one of the components of the wilderness experience and its relative importance surely varies among users. Also, even for those to whom solitude is important, it may be that other aspects of the wilderness experience compensate (in a sense, increase in their relative importance) when use levels are high enough that solitude is difficult to find. Thus, although the level of use might be fairly high, there are other features of the trip that still make it worthwhile: new acquaintances were made, the scenery was superb, the hike was challenging, and so forth.

We need to also recognize that the investigations of visitor ideas about crowding may be simply missing those users to whom solitude is especially important. For these people, conditions may have already exceeded some critical threshold of sensitivity; they have already sought other places where use conditions are still consistent with their desires. These "displaced" persons represent a measure of the cost involved when a carrying capacity constraint is not imposed.

Finally, reports of satisfaction need to be understood in the context of what was expected. Where expectations are poorly defined (e.g., a first-time visitor has little basis for knowing what to expect), satisfaction with the experiences are difficult to assess. Crowding is generally recognized as a personal judgment or assessment about some physical condition measuring people per unit of space (Altman 1975). Moreover, the context of the situation is important. Judgments about whether the number of people present in a situation--the density--is a crowd or not depends on the nature of that situation. A cocktail party can have too few people; a wilderness campsite can have too many, even though the same number of people might be involved in both situations. And, what is judged to be appropriate is largely a function of the norms (rules, either written or unwritten) that govern the situation. Thus, where norms are poorly defined or poorly understood (e.g., as by a novice wilderness user) the evaluation of use conditions as being crowded, just right, or underused will be inconsistent and variable.

What the lack of association between use and satisfaction does suggest is that the notion of managing wilderness to "maximize satisfaction" is probably not a very effective or useful management idea. Why not? Satisfaction is a very general, inclusive concept; the difficulty of using it to guide carrying capacity decisions is that it will probably continue to rise over time because people will continue to report, typically, that they enjoy their outdoor experience. However, at the same time, we must recognize that the nature of the experience is changing constantly--there is a *shift in product* from a wilderness-dependent experience to one simply enhanced or incidental to a wilderness setting.

This change in the nature of the opportunity and the kind of experiences offered is central to the carrying capacity issue. Rather than managing to maximize satisfaction or uncritically accepting the argument that because there is little observed relationship between increasing use levels and satisfaction, solitude is not important, the task of wilderness managers ought to be the development of policies to insure preservation of opportunities producing wilderness-dependent experiences. Solitude is an important feature of the wilderness experience to many people and is backed by a legislative mandate. Increasing use restricts the degree to which visitors can find solitude and although there are various techniques or mechanisms that people can adopt to achieve solitude (e.g., going during the off-season, traveling cross country), the opportunity to find solitude will eventually diminish if use continues to grow. Rather than attempting to define capacity through some quantitative estimation of satisfaction, the challenge is to develop area management plans that insure maintenance of opportunities where the ranges of inter-human contact normally prevailing is low.

APPLYING THE CARRYING CAPACITY CONCEPT TO WILDERNESS

Even though there are various definitions of carrying capacity used by biologists, range managers, and others, in general the concept is used to describe the relationship between the productivity of a resource and the ability of that resource to maintain its productivity. For instance, the long term productivity is diminished as intensified grazing exceeds the natural regenerative capacity of the range.

We can apply this same basic principle to wilderness management. In wilderness, the product of management programs is a set of human experiences that are linked to the naturalness of the environmental setting, and thus to a very low level of development, and to a generally low level of contact with others. These elements appear to be basic attributes of the "wilderness" experience, even though the term refers to what is, in fact, a complex and diverse set of experiences which different individuals might or might not share.

However, the qualities of naturalness and solitude are subject to change. For instance, as recreational use increases, opportunities for solitude decline while the probability of substantial modification of ecosystems increases. Excessive change might be reflected in the form of a social cost (e.g., congestion with resulting impacts on the wilderness experiences), an environmental cost (e.g., loss of water quality, vegetation impact, disturbance of wildlife population), or a combination of the two (e.g., a severely impacted campsite that represents a substantial modification of an ecosystem as well as an esthetically unattractive scene). Any of these impacts represent a loss in wilderness carrying capacity because they adversely affect the long-term capability of the resource to produce the kinds of experiences required by the Act as well as dependent on wilderness.

Change can emanate from a variety of sources. The most significant source is recreation use. However, other sources of change must also be considered.

CHANGE - A KEY ELEMENT

Pervasive, global pollution (a source of change over which managers have little control) represents a particularly odious type of influence because of its subtle character and the difficulty of tracing its origins. Radiation, pesticides, and air pollution are examples. For instance, flouride pollution from the Anaconda Aluminum Company plant near Columbia Falls, Montana, has caused vegetation damage over 10 miles away in the Flathead National Forest and Glacier National Park (Carlson and Dewey 1971).

Wilderness boundaries serve as very poor shields against many impacts. Management programs and other practices on adjacent, nonwilderness lands can have profound impacts on runoff, microclimate, or nutrient availability in nearby lands supposedly protected by the Wilderness Acts. Developments on nonwilderness lands can alter the distribution, behavior, and, often, even numbers of wilderness wildlife species. The development of roads close to the wilderness boundary can lead to significant changes in the patterns and style of use within the wilderness. As we discussed in Chapter 7, it is important to encourage a holistic view of wilderness, one that encompasses not only the wilderness proper, but surrounding lands as well.

Management decisions within wilderness itself can also introduce stress. For instance, with a few notable exceptions, current policies in the wilderness management agencies generally call for complete control of fire. The control of fire--one of the most significant natural forces in wilderness--has had decided impacts on the evolution and development of wilderness ecosystems (see Chapter 12). Other management policies, affecting activities such as commercial and recreational stock use, have similar impacts on ecosystems.

In many areas, the presence of activities and facilities established prior to wilderness classification can represent a significant loss in capacity. For example, sheep and cattle grazing still occur in much of the Bridger Wilderness in Wyoming, and the dust, vegetation loss, and odor are major sources of complaint from many visitors (Stankey 1973). Most of these changes are protected as preexisting rights under the Wilderness Acts. Nevertheless, they should be viewed as permissive and necessary political compromises, not as measures of the intent of wilderness classification.

Thus, many forces lead to change in wilderness. The term "preservation" does not refer to the maintenance of a static "picture" of the American landscape at some point in time; rather, it refers to the preservation of conditions that allow natural ecological forces to operate as they have for eons--as far as possible, beyond man's control. Our concern with change of the sort described in this chapter centers on the extent to which the natural process of change is disturbed, restricted, or altered. In wilderness management, we are primarily concerned with controlling and minimizing man-induced change, rather than with change per se.

Change itself is a natural characteristic of wilderness and is a key element in understanding carrying capacity. It is the norm; conditions change constantly in response to natural forces. Also, as we noted in the earlier review of literature on ecological impact, only small amounts of stress (e.g., recreation use) can produce large amounts of change both socially and ecologically. Graphically, this relationship between stress (use) and change, either social or ecological, can be shown as in Figure 1. As stress increases, the qualities

Figure 1.--Impact of increasing stress on wilderness quality.

of naturalness and solitude are diminished and although the slope of the curve varies according to the specific conditions involved, the overall implication is that use, allowed to increase unchecked by a carrying capacity constraint, will eventually reduce, or even eliminate, wilderness quality.

Another significant implication of this general relationship between use and change is that the decision to allow any use in wilderness is also a decision to allow some amount of unnatural change. Moreover, if we seek to keep man-induced change at a bare minimum it will be necessary to restrict use at extraordinarily low levels; perhaps in some areas it would mean no use at all (Wagar 1968).

But the Wilderness Acts tell us that use is consistent with the wilderness concept. Moreover, it is unlikely that extremely tight restrictions on use would be politically acceptable (e.g., see DeFelice 1975).

Thus, it seems that use will occur and that use-related change--either in environmental quality or in the kind of experience available--will be a fact of life with which managers must contend. The question the manager must confront is not "Do I allow change to occur" but "How much change can occur without impairing the qualities that made this area a wilderness?" What consitutes excessive change? How can a manager make a decision that is not arbitrary and capricious? It is a difficult job; there are no readily available measures which warn managers: "use cannot exceed this point." But the situation is not hopeless. Carrying capacity can become an effective tool for wilderness managers, as the following discussion indicates.

THE ROLE OF MANAGEMENT OBJECTIVES

The key to dealing with carrying capacity lies in the specification of explicit and detailed management objectives. As we discussed in depth in Chapter 8, a major shortcoming in most wilderness management plans is the lack of objectives that allow managers to specify the conditions they seek and to measure performance with regard to achieving those objectives. The failure to develop such objectives is also the reason that specifying wilderness carrying capacities has remained an elusive task.

Management objectives define the physical, biological, and social conditions within wilderness that management programs seek to create, restore, or maintain. They serve as criteria for management policies and actions to achieve these conditions; thus, the objectives for recreation use, trails and travel, fish and wildlife, etc. serve as the criteria for establishing carrying capacities and the policies and actions needed to hold use consistent with these capacities. Objectives are prescriptive; i.e., they tell what conditions should be like. This characteristic allows managers to review conditions at any given point in time in order to determine the discrepancy (if any) between the conditions desired and the conditions that exist. To the extent that a discrepancy does exist, management policies and actions can often be applied to lessen the difference. Similarly, objectives serve as criteria that allow managers to review the likely outcome of different use configurations and to judge whether the probable consequences are compatible with established objectives.

Obviously, management objectives must be both site-specific and detailed. Vague statements, such as "Management will seek to insure preservation of native fauna" are too imprecise to permit managers to assess their progress toward that goal. As discussed in Chapter 8, the lack of precision, specificity, and detail in stated objectives is the source of many management problems, and it is certainly at the root of the difficulty encountered in attempting to formulate wilderness carrying capacities.

Management objectives provide managers with several critical pieces of information. They describe the nature of the experience to be produced, they serve as the operational objectives by which all management decisions must be formulated (see Chapter 8), they define what tools and strategies are appropriate for use by managers, and they serve as a check to test progress toward their achievement.

In the case of wilderness, we are attempting to manage areas that show minimum evidence of man, that provide visitors with an opportunity to see nature's forces with as little confinement and regulation as possible, and that minimize intergroup contact. These are admittedly general aims, but they do give us some pretty definite clues as to the types of experiences we ought to provide in wilderness. They also rule out certain actions that might be appropriate and customary in other resource management. For instance, reseeding impacted sites with hardy, tolerant grasses, exotic to the area, is inappropriate in an area managed for naturalness.

In this chapter, we have considered the causes and impact of stress on wilderness and the resulting physical and social changes it produces. We have also discussed management objectives--the role they play and some guidelines for their formulation. To tie these elements together, we now turn to a framework within which we can address the basic question facing wilderness managers attempting to determine carrying capacity. "Given the inevitability of change, what are the limits of acceptable change that may occur without the loss of those qualities that led us to define this land as wilderness?"

DEFINING THE LIMITS OF ACCEPTABLE CHANGE

As we have already noted, change is a fact of life with which wilderness managers must contend. Natural ecosystems are constantly evolving and our wilderness management programs should permit this natural evolution. Man-caused change, on the other hand, brought about either by direct impacts of man (e.g., recreation) or through management policies (e.g., fire exclusion), is something management should minimize. Similarly, the social aspects of wilderness also change. Absolute solitude (the complete absence of other people) is seldom experienced--the social environment that characterizes wilderness is usually modified. Likewise, the natural environment will almost always show some signs of modification and the human satisfactions gained from the enjoyment of pristine nature may be correspondingly lessened. In either case, excessive change alters the capability of the wilderness resource to offer the kinds of experiences associated with wilderness; in other words, it reduces wilderness carrying capacity.

Change, occurring in both the ecological and social realm, is not only continuous; it is also complex and interdependent. The biological changes (e.g., soil compaction) which have obvious ecological implications also affect visitor satisfaction. Likewise, social changes (e.g., increased congestion around lakes) have impacts that are both biological and social. Let's take a closer look at these ecological and social systems and attempt to bring some order to this complexity.

Establishing Ecological Limits of Change

Ecosystems evolve with regard to both character and rate. By character, we mean the composition of the biological system; the species, the relative frequency of the different species, and so forth. Man's influence can affect the character of ecosystems by introducing exotic species, eliminating others. Additionally, the composition or character of any ecosystem changes over time and the rate of this change can be influenced (either retarded or accelerated) by man. Man's impact, then, can lead to variations in both ecosystem character and the rate of evolution beyond what we would expect to occur under long-term averages.

Figure 2 presents this relationship. The central band labeled "Natural

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Figure 2.--Model of acceptable ecological variation in wilderness.

Variation in Rate and Character of Use" represents the natural range one would expect to occur without man's influence. But as we have discussed, man's pervasive influence has altered the natural order. Thus, some man-caused change in both character and rate is expected and accepted. However, at some point this change becomes excessive; i.e., the conditions that prevail no longer represent wilderness. It is at this point that the ecological carrying capacity of the area has been exceeded. The definition of the point at which an area is still representative of wilderness while accommodating its maximum use (i.e., its carrying capacity) is incorporated within the area's management objectives and the accompanying standards established to measure performance toward achievement of those objectives.

This, of course, is a very simplified model of what in reality is very complex (see Chapters 10, 11, and 12). Ecosystems are composed of numerous diverse components that are interrelated in ways that are often poorly understood. Changes occur in each individual resource element. For example, the introduction of any particular use configuration leads to change in soil bulk density, percentage of ground cover at campsites, wildlife behavior patterns, and so forth. Thus, our model of ecological carrying capacity actually must be repeated for each of these elements as well as for other variables that can be isolated for study. The most sensitive indicator becomes the limiting factor. For example, the wilderness manager might establish a series of standards for a given area in order to measure performance toward achievement of the area's management objectives. These would clearly and precisely specify the environmental conditions desired at that location in order to achieve those objectives. They might indicate the maximum amount of ground cover that would be permitted to be lost at campsites, the level of coliform bacteria permissible in lakes, the extent of intrusion of exotic plant species, and so forth. Such standards might be derived from data generated in studies in the area, by interpreting from data generated elsewhere, or from judgment based on his own experience.

For each environmental parameter, a "Limit of Acceptable Change" should be established (Frissell and Stankey 1972). Managers would then be alert for a change in conditions that exceeded the established limit. Conditions that exceed limits (or give managers strong reason to believe that excessive change is imminent) would call for a change or new emphasis in policies and actions to minimize the impact. These might range from light-handed restoration to restrictions on visitor numbers (see Chapter 14 and 15 for specific techniques of site and visitor management).

How does one go about setting "Limits of Acceptable Change"? There are no clearcut procedures. In some cases, however, managers might be able to make a relatively easy decision. Consider, for example, situation A in figure 3,

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Figure 3.--Hypothetical relationship between use and environmental damage.

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a hypothetical diagram of the relationship between total use and environmental change along a trail.

Up to a certain point, the environmental change recorded is low and relatively stable. (Such information on the amount and rate of change could be obtained through such techniques as permanent photo points, systematic trail condition reports, or even the judgments of field personnel. More detail on these techniques is in Chapters 14 and 15). Then, there is an abrupt shift upwards. Managers might establish standards that specify that conditions will not exceed those beyond the abrupt shift in the curve. In such a case, the basis for establishing the limit of acceptable change becomes a relatively easy task.

In many other cases, however, there will be no readily apparent point beyond which change should not be allowed. For example, change might be steady and constant as in situation B of figure 3. There is no obvious point at which an abrupt or noticeable shift occurs; managers are thus faced with establishing the limits of acceptable change in the absence of any distinct discontinuities. Management judgment thus becomes a crucial part of the carrying capacity process, a subject we will discuss in more detail shortly.

Establishing Social Limits of Change

The model we have described for ecological carrying capacity can be repeated for establishing social limits of change. It is somewhat more difficult to describe our starting point for social change than for ecological change, however. What is loosely referred to as the "wilderness experience" is, in fact, a composite of diverse human experiences related to wilderness. For some people, solitude is the key value. For others, it is the challenge offered by an area where man is on his own. For still others, it is the opportunity to anticipate or witness the untrammeled processes of nature. Thus, rather than viewing the wilderness experience in figure 4 as some fixed, unbending definition,

Figure 4.--Model of acceptable variation in wilderness experience.

it is better to think of it as a generalized and hypothetical concept.

For the purposes of discussion, let's assume that the "perfect" wilderness experience offers the user complete solitude, an opportunity to appreciate and study completely undisturbed ecosystems, the ultimate in challenge, and the absence of facilities or aids. In reality, of course, wilderness in North America does not offer such conditions. Wilderness has been tamed in varying degrees. Nevertheless, the Wilderness Acts are clear in terms of their general intent; wilderness should offer low intensities of use, a relatively unmodified setting, challenge, and a chance for discovery. Constantly meeting others along the trail does not seem a part of the wilderness experience, nor do bare and dusty campsites and trampled vegetation. To accommodate these variables, the model in figure 4 recognizes two important factors for establishing social use limits: human contact and visitor perception of resource quality.

As suggested above, there is probably relatively good agreement on the general nature of the essentials of the wilderness experience. The principal difficulty does not emerge until we attempt to develop more precise guidelines. At what point does contact with others change from being a pleasant and even welcome interlude to an unwelcome invasion of privacy? The question centers on a value judgment, but whose values: users or managers? Whose judgment should predominate? These two groups often hold very different views (Hendee and Harris 1970; Hendee and Pyle 1971). Resolving in favor of the user doesn't always help because wilderness users are spread across a wide spectrum, ranging from the inveterate enthusiast to the one-time, casual drop-in. Assuming a single standard for judging acceptable change is wrong; striving for an average is also unrealistic.

Several efforts have been made to deal with problem. Lucas (1964) argued that BWCA managers give more attention to the attitudes of canoeists than to motorboaters because their behavior was more in keeping with area management objectives--they were canoeing, rather than using a motor, in an area established primarily to provide an opportunity for wilderness canoeing. The Outdoor Recreation Resource Review Committee wilderness report (1962) used amount of past wilderness experience as a measure of commitment. Hendee et al. (1968) and Stankey (1973) used attitude scales to differentiate users on the basis of the "purity" of their attitudes toward wilderness, arguing that the standards ascribed to by those scoring high in purity should be given particular attention by decisionmakers.

These examples illustrate a management guideline we advocated in Chapter 7--feature wilderness-dependent activities. The process of defining the primary clientele group is something managers cannot avoid. The principle of featuring wilderness-dependent activities offers a logical and systematic procedure for helping to define this group. By assigning first priority to the needs of users who, by their behavior and/or attitudes reveal a dependent relationship to wilderness (that is, whose use and experiences can be satisfied only, or at least largely, by the primitive, unmodified, and low-use-density setting offered by wilderness) managers can most effectively utilize public input to guide carrying capacity decisions.

As with the ecological model of capacity, the social model involves a number of specific elements, any one of which might define an area's social carrying capacity. A manager will want information about total number of encounters, encounters with other kinds of users, crowding at campsites, and so forth. Judgments about acceptable limits for each element comprise standards; when approached or reached they constitute a limit on further use. For example, managers might suggest that, on the average, wilderness parties should not meet more than three other parties per day. If information obtained by wilderness rangers or through use surveys indicates that most parties encounter five other groups per day, managers might decide to remedy this through a program of use redistribution, giving visitors information about use conditions so that people concerned with solitude might alter their routes to achieve this personal objective. If this technique doesn't reduce encounters, direct rationing of use might have to be instituted. The point is, management actions are taken as part of a logical and visible process intended to help achieve an established objective.

But, the social aspects of wilderness must be meshed with the ecological. The two models we have described must be considered together so that neither the unique environmental qualities of wilderness nor the special human experiences available in wilderness are lost. Let's consider examples of the way such a composite model of wilderness carrying capacity might work.

AN EXAMPLE OF CARRYING CAPACITY DETERMINATION

Let us imagine that managers of the Red Mountain Wilderness have written a management plan with management objectives and have developed accompanying standards that specify limits of acceptable change for the major ecological and social parameters of the area. One management objective concerns campsites in the area: wilderness campsites shall be managed to preserve the naturalness of vegetation, continuity of ground cover, and opportunity for solitude at individual sites. This objective is further clarified by policies that include specific standards:

1. The maximum extent of ground cover loss to be tolerated at any campsite shall not exceed 50 percent of the amount within the general area of the fire circle and tent location;
2. Campsites will offer, wherever possible, an opportunity for visitors to camp out of sight and sound of other camps and will take advantage of vegetation and natural barriers. Use levels at campsites should be such that parties shall generally not need to camp within sight or hearing of one another.

Both of these standards have been developed from data generated in studies of the area by a local university. When ground cover losses exceed 50 percent, natural recovery by the following year is generally not possible. Campsite solitude has been cited by visitors as an especially important part of the experience; consequently, an attempt has been made to physically locate sites away from one another. Where one site is located within sight or sound of another, the policy calls for limiting use levels so that normally both sites will not need to be occupied.

As use builds up through the summer, wilderness rangers report that a number of campsites are close to losing one-half of their ground cover and the rangers report that they anticipate substantially greater loss if use continues unabated. Given the management objective and policies noted above, then, these sites are approaching their ecological capacity.

Managers now have several alternative actions they might consider. They could close off those sites to any further use. Or, they could reduce total use in the area to such a point that the sites could begin to recover. They might also consider restoration of the camps (e.g., scarifying the sites, planting native grasses).

In this case, managers choose to close those sites in danger of losing over 50 percent of their ground cover. This is accomplished through a program involving information distribution about the closure to users and enforcement of the closure through site restrictions, enforced by information and education contacts by wilderness rangers. No control over total use is imposed.

With the number of available campsites now reduced, demand for the remaining sites grows. Wilderness rangers begin reporting that on most evenings, several parties have set up camp around existing sites and it is not uncommon to have three or four other camps within sight and hearing of one another. Here, the second policy is in danger of being exceeded. The limits of acceptable change established for campsite solitude has been exceeded, and again, management action is called for. Now, a social factor controls capacity; the physical-biological resource is not threatened at present and might even be capable of supporting more use. But in this case, visitor solitude is the most sensitive indicator of capacity and is the cue managers use to take action by implementing a policy.

As was the case in deciding how to prevent excessive vegetation loss at campsites, several alternative actions are open to managers. They could attempt to redistribute use to new campsites. Obviously, they would need some measure of how many new or potential sites exist; we will examine this problem in greater detail in Chapter 15. Or, regulations could be imposed that simply prohibit camping near others. To prevent congestion, managers could begin assigning users to campsites. They might, as has been done in the Shenandoah Wilderness, restrict all camping within sight or sound of trails or other camping parties. Finally, total use could be controlled. Deciding the most appropriate course of action is a manager's job. Each action has certain costs and benefits associated with it; there is no simple answer. The principles described in Chapter 7 will prove useful in making this decision.

The above examples demonstrate how either ecological or social elements might lead to a judgment that a wildernesses carrying capacity limits have been reached. In both examples, managers determined that conditions were inconsistent with established wilderness objectives. It is especially important to note that research data did not, by itself, reveal what decision should be made. Rather, in light of what was known, managers had to weigh the apparent consequences of alternative decisions and then choose the most appropriate course of action. This is why management objectives play such an important role in the carrying capacity equation--they provide the framework within which the consequences and implications of decisions can be reviewed and tested for appropriateness.

SUMMARY

There are three key ideas to keep in mind in the application of the carrying capacity concept to wilderness management. First, establishing carrying capacit is not a process of developing "magic numbers" that tell how much use should be allowed. Rather, it is a matter of determining what kind of social and environmental conditions we want to provide (i.e., establishing management objectives), reviewing the probable consequences of different use configurations on that desired outcome, and prescribing policies and actions that will attain those objectives. Management judgment is the key element in this process. Judgment is a product of experience, research data, basic inventory information, and good common sense. Computers and other sophisticated analytical tools are just that--tools. They help managers do a better job of accumulating, reviewing, and evaluating information, but they do not make decisions--people do.

Judgments can still be arbitrary and capricious, particularly if made in the absence of any substantive information. Thus, the second basic idea is that establishing carrying capacities is dependent upon the formulation of explicit management objectives that provide precise measures of desired conditions. These objectives and their associated policies define the limits of acceptable change for as many ecological and social elements of the wilderness as can be identified.

Finally, either ecological or social factors can lead to a determination that an area has reached its capacity. The point at which the most sensitive indicator or "weakest link" is reached becomes the point at which managers must take action. Their response can vary widely, from merely implementing policies to changing the management objective (thus changing the definitions of the limits of acceptable change). The management objectives, coupled with the principles described in Chapter 7, help determine what policies and actions are most appropriate to achieve them.

The primary responsibility for preparation of chapter was with George H. Stankey.

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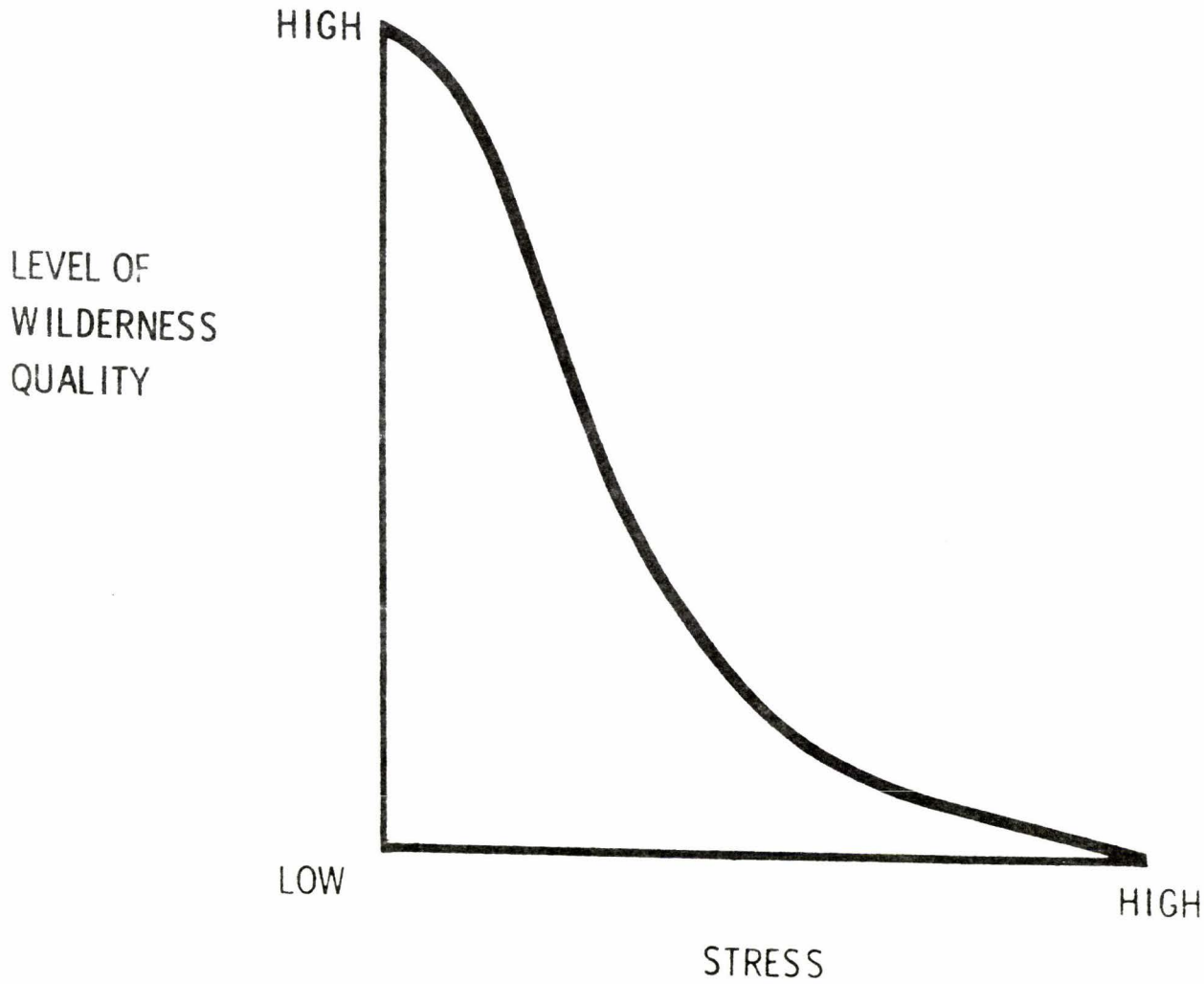
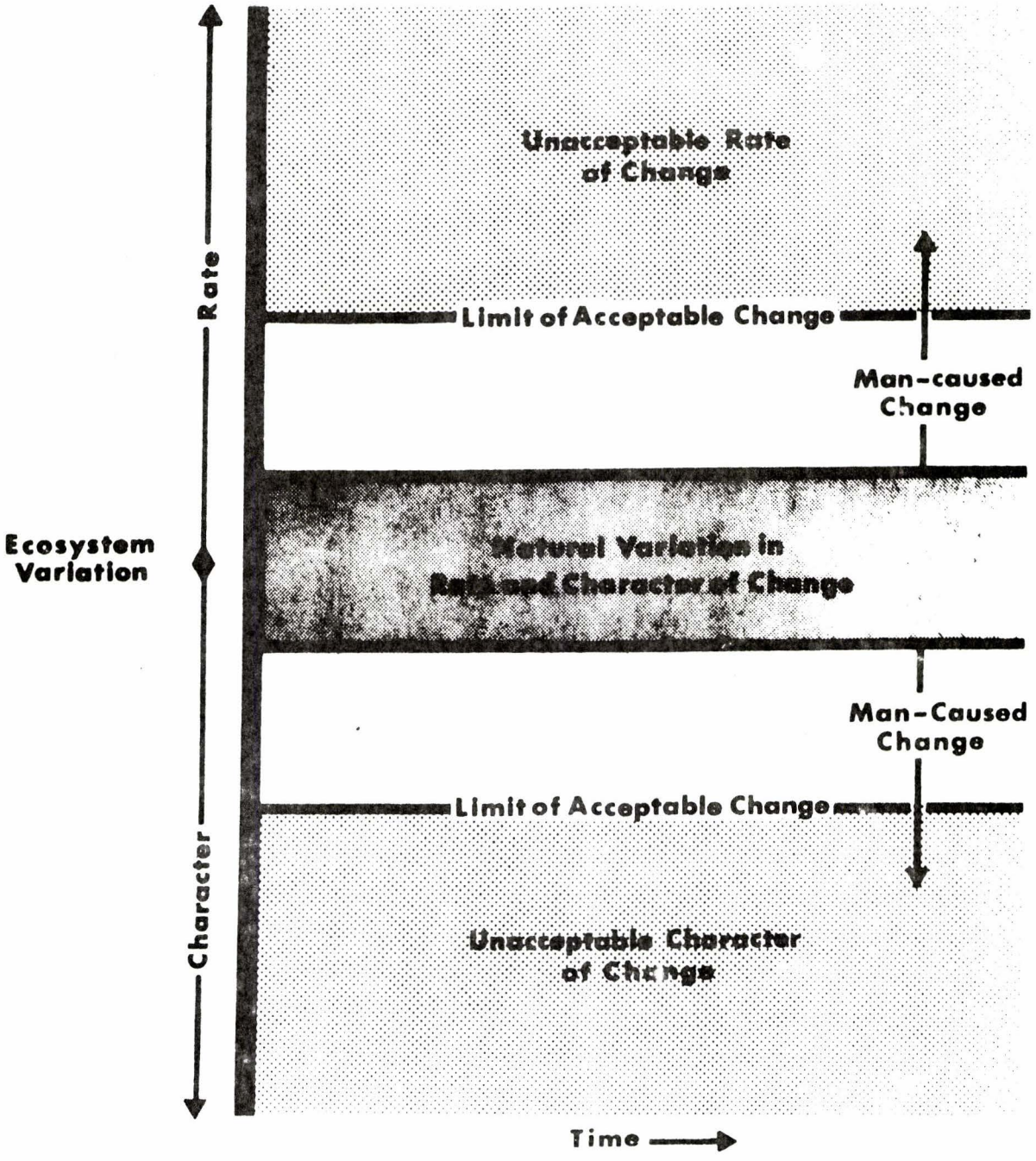
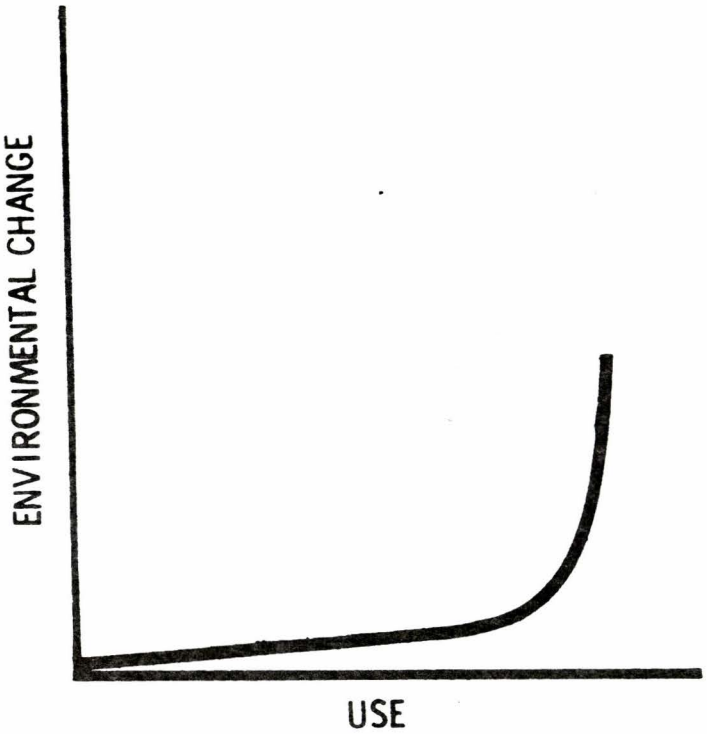
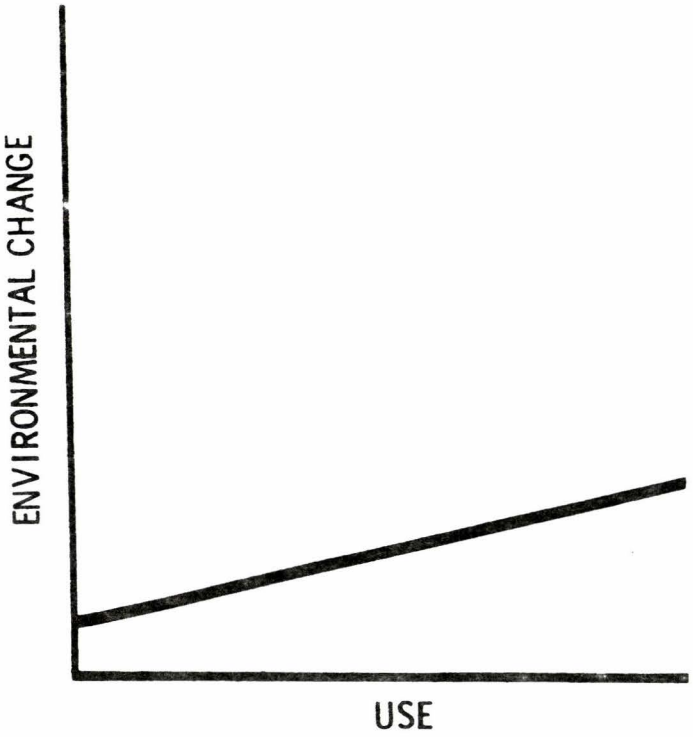

HIGH
LEVEL OF
WILDERNESS
QUALITY
LOW
HIGH
STRESS



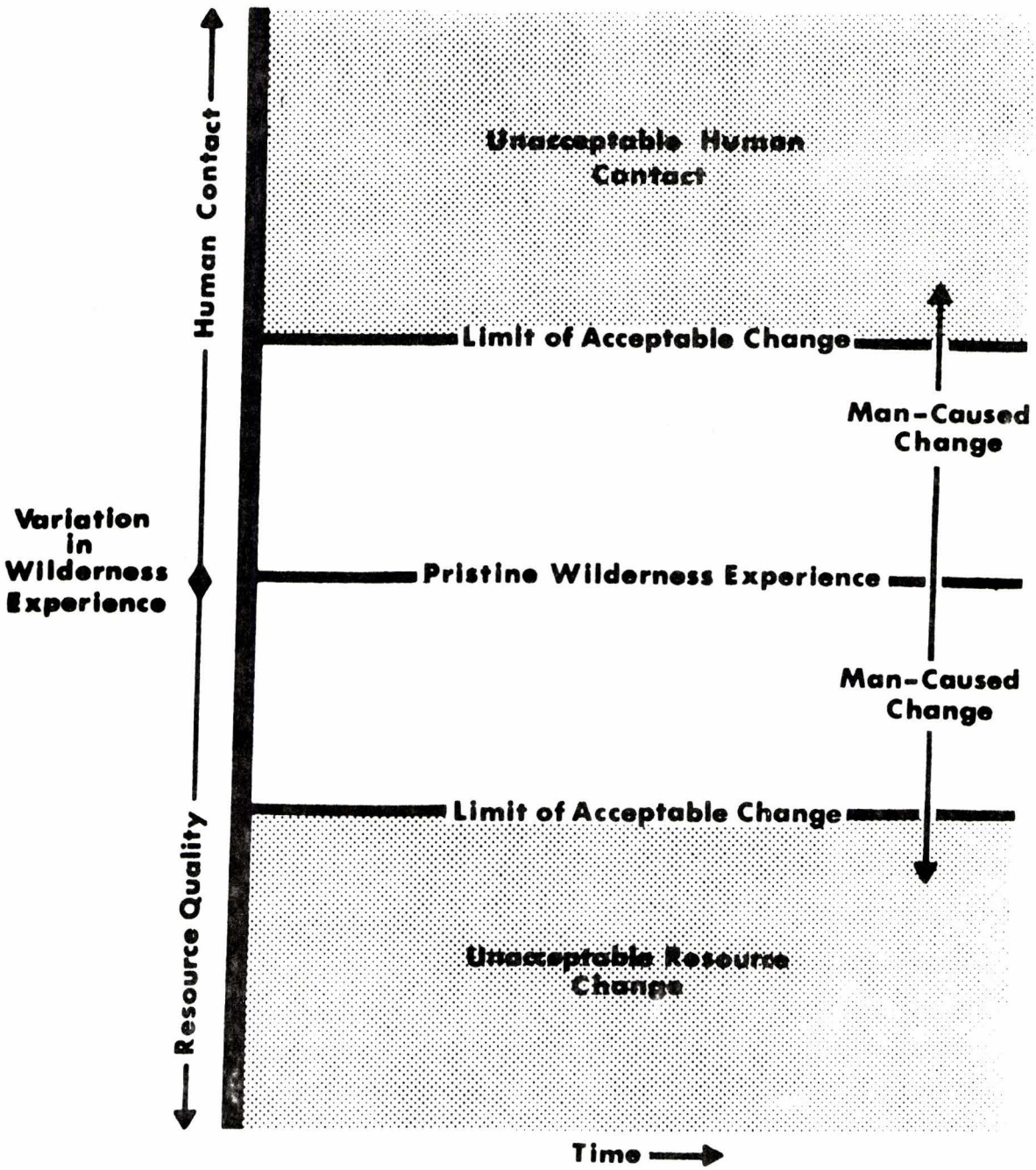
Model of Acceptable Ecological Variation in Wilderness



SITUATION A Here an abrupt shift in the rate of change helps define the limits of acceptible change.



SITUATION B Here a continuous low rate of change provides no clear evidence where the limits of acceptible change should be established.



Model of Acceptable Variation in Wilderness Experience

MANAGEMENT UNIT DELINEATION ANALYSIS

APPENDIX Pages 84 to 85

These are the notes of the process we went through to arrive at our recommended procedure for delineating management units.

The task force put a great deal of thought and discussion into a method for the delineation of mangement units. The first step was simply to "brainstorm." This produced a variety of methods of which the following were considered viable:

1. Types of Users (Horsemen, hikers, fishermen, etc.)
2. Wildlife Species
3. Ecological Land Units
4. Travel-use Patterns
5. Physiography
6. Administrative Boundaries
7. Habitat Types (Pfister)
8. Elevation
9. Kuchler-Bailey Ecosystems
10. Degree of Naturalness (Impacts)
11. Landform
12. Topography

Once this step was completed, the need to set criteria for judging the applicability of each of the methods was recognized. Fifteen criteria were recognized initially, but consolidation of some and deletion of others, produced the following criteria whereby the methods were judged:

1. Practicality and Cost to the Manager
2. Public Comprehension
3. Acceptance - Political Considerations
4. Flexibility of the System
5. How Does It Relate to Actual Use
6. Suitability for Other Management Considerations
7. Relationship to Social Capacity
8. Relationship to Physical Capacity

The preceding criteria were applied to each of the identified methods. The following chart illustrates the relative value of each method when judged according to the criteria.

From the chart it was apparent that about five different systems would be suitable. Through much discussion and compromise, we came up with the combination of travel patterns (or use areas) and the lands general capability to sustain use.

	Users	Wild Life	ELU	Travel Patterns	Physio-graphy	Admin. Bdry.	Habitat Type	Elev.	Kuchler-Bailey	Impacts	Land Form	Topo-graphy
Practicality	No	No	?	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
Public Compre-hension	No	No	Yes	Yes	Yes	Yes	Yes		Yes	?	Yes	Yes
Political Acceptance	No	No	Yes	?	Yes	?	Yes		?	?	Yes	Yes
Flexibility	Yes	No	Yes	Yes	?	No	Yes		No	Yes	Yes	Yes
Relation to Actual Use	Yes	?	Yes	Yes	No	No	Yes		No	Yes	Yes	Yes
Suitability for Other Mgt. Con-siderations	No	No	Yes	Yes	Yes	Yes	Yes		?	?	Yes	Yes
Relationship to Social Cap.	Yes	?	No	Yes	No	No	Yes		No	Yes	Yes	Yes
Relationship to Physical Cap.	Yes	?	Yes	?	Yes	No	Yes		?	Yes	?	?
Weighted Total	16	11	20	22	19	15	24		15	23	23	23

Scoring Value: Yes = 3
? = 2
No = 1

CODE-A-SITE PROCEDURE FOR WILDERNESS

APPENDIX Pages 87 to 111

This is a modified Code-A-Site method specifically designed for the Selway-Bitterroot Wilderness. The overlay adds or adjusts the information collected for wilderness purposes. The written instructions for making the changes are included here. This procedure was adopted by the Rangers in the Selway-Bitterroot in 1976. Field training of wilderness rangers in this procedure started in 1976 and was completed in 1978. Continued training of new employees will be necessary.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

Moose Creek Ranger District

REPLY TO: 2320 Wilderness

May 16, 1977

SUBJECT: Selway/Bitterroot Wilderness Carrying Capacity Study

TO: Regional Forester; Forestry Sciences Laboratory; Forest Supervisor: Bitterroot; District Rangers: Darby, Lochsa, Missoula, Moose Creek, West Fork, Powell, Stevensville, and Wisdom Ranger Districts

Attached is a proposed format for the campsite inventory portion of the data collection job. It borrows liberally from work by Dick Walker, recommendations from the June 1976 Selway/Bitterroot Wilderness Ranger Seminar and the basic Code-A-Site system developed by Hendee, Wood, Hogans and Clark.

The Code-A-Site definitions and modifications are the result of a meeting held at Moose Creek on August 31 and September 1, 1976. Participants included most of Moose Creek's crew, Dick Walker, Melissa Patterson and Tom Kovalicky. It was the consensus at that meeting that the Code-A-Site card should be modified to collect some additional data needed in wilderness, using space specified for roaded or developed sites.

Some trial runs showed us that the existing card was awkward to use with the changes. A new card designed for wilderness appeared to be our best course. To test this proposal Tom Kovalicky coordinated a regional workshop. When the results were in it appeared that wilderness managers in Region One were not ready to use a modified card. The option of an overlay for the existing card was discussed at the workshop, however, and this is the course we have recommended for the Selway/Bitterroot study.

A transparent overlay is attached along with a Code-A-Site card. When the overlay is placed over a Code-A-Site card, the various block descriptions will correspond with the code book. There may be better ways to build an overlay. Suggestions are welcome. If you want one more neatly drafted, feel free to prepare your own. By laminating the overlay it can be stiffened and waterproofed. The center can be cut out so that the center remarks space can be written on without raising the overlay. Two pins through a clipboard that correspond with holes at the top of the card and overlay might help keep them aligned.

Stage 2
Stage 3
Summer, Spring & Fall
Summer
Fall
Winter
Year long
Mainline
Secondary
Manway

Inventory Stage

Season of Potential Use

CLEAR PLASTIC OVERLAY
FOR WILDERNESS CODE-
A-SITE USE

Lake
Stream
Meadow

Aircraft
foot/horse
Boat/all

Type of access

Temp.
Perm.

Management
Site Carrying Capacity
People 1-5
People 6-10
People 11+
Stock 1-5
Stock 6-10
Stock 11+

Source of impact by mode of Travel

Historic
Minerals
Archaeologic
special use

Beach

Flowers

CHECK (X) APPROPRIATE CATEGORIES

PLEASE READ CODE BOOK PRIOR TO USING THIS CARD

CODE - A - SITE
(DISPERSED RECREATION SITE INVENTORY)
U S D A FOREST SERVICE
PACIFIC NORTHWEST FOREST & RANGE EXPERIMENT STATION

5-75 Z10923X MCBEE® SYSTEMS SEATTLE, WA.

KEY #

USE THIS AREA WHEN SPECIFICS ARE REQUIRED OR TO RECORD ADDITIONAL DATA

ADDITIONAL NOTES ON REVERSE ☐

I DESCRIPTIVE

TYPE OF AREA (1)
- DISPERSED
- K COUNTRY
- WILDERNESS
- OTHER (SPECIFY →)

(2)
- YEAR ROUND
- SEASONAL (SPECIFY →)

ACCESS

ROADS (SPECIFY NAME OR NO. IF ANY →) (3)
- MAIN ROAD
- SPUR ROAD
- INFORMAL ROAD
- 4 WHEEL DRIVE ROAD
- OTHER (SPECIFY →)

TRAILS (SPECIFY NAME OR NO. IF ANY →) (4)
- MAIN TRAIL
- SPUR TRAIL
- PATH
- CROSS COUNTRY
- OTHER (SPECIFY →)

DISTANCE FROM TRAIL OR ROAD (5)
- 0 - 50′
- 51 - 100′
- 101 - 200′
- OVER 200′

_____ FT.

TYPE OF SITE (CHECK ONE FOR ROADED AREA) (6)
- TURNOUT
- TRAIL HEAD
- ACENT ROAD
- OTHER (SPECIFY →)

TENTS (7)
TENT SUITABILITY ← YES ☐ NO WHY? →
1 ● 2 NO. OF TENT SPACES _____
3 ● 4+

VEHICLES (8)
VEHICLE SUITABILITY ← YES ☐ NO WHY? →
1 ● 2 NO. OF VEHICLE SPACES _____
3 ● 4+

SITE ORIGIN & CURRENT STATUS (9)
- OFFICIAL
- IMPROMPTU
- UNIMPROVED
- MINOR (SPECIFY →) IMPROVEMENTS
- MAJOR (SPECIFY →) IMPROVEMENTS

OTHER SITES (10)

NO. IN VIEW
- 0
- 1 - 3
- 4 - 5
- 6 +

NO. IN ½ MILE
- 0
- 1 - 3
- 4 - 5
- 6 +

VII SCHEMATIC DRAWING

USE BOX TO MAKE A ROUGH SKETCH OF SITE

INDICATE POSSIBLE TENT (X) AND VEHICLE (O) SPACES

INDICATE NORTH

VI ECOLOGICAL

EXTRA CODING FOR LOCAL USE (28)

B	A	●	1
D	C	●	2
F	E	●	4
H	G	●	1
J	I	●	2
L	K	●	4
N	M	●	2
P	O	●	1

FREQUENCY OF USE (27)
- CONSTANT
- FREQUENT
- MODERATE
- SLIGHT
- INFREQUENT

ELEVATION (26) _____ FEET
- UNDER 1000
- 1000-2000
- 2001-3000
- 3001-4000
- 4001-5000
- 5001-6000
- 6001-7000
- 7001-8000
- 8001-9000
- 9001-10.000
- 10.001 +

EXPOSURE (25)
- NE NORTH
- NW EAST
- SE SOUTH
- SW WEST

CROWN COVER (24)
- NONE
- 1-25%
- 26-50%
- 51-75%
- 76-100%

(23) VEGETATION SPECIFY ON BACK — NO GROUND COVER

GROUND COVER (22)
- 1-25%
- 26-50%
- 51-75%
- 76-100%

IMPACT OF PREVIOUS USE (21)
- EXTREME
- HEAVY
- MODERATE
- LIGHT

V

(20) SPECIAL PROBLEMS FOR USER (← SPECIFY) NO ☐ YES →

IV FACILITIES

(19)
- NO FACILITIES
- GARBAGE CANS
- INFORMATIONAL SIGNS
- TABLES
- FIREPLACE

TOILETS (18) (SPECIFY LOCATION) ←
- NONE
- PIT
- PIT STRUCTURE
- SEALED VAULT

II SITE RESOURCES

WATER (11) (SPECIFY LOCATION)
- ITE ☐ NO
- SITE ← YES ☐ NO
- STREAM
- SPRING
- LAKE

FIREWOOD (12) (SPECIFY LOCATION)

AVAIL.	SOURCE		AMOUNT	
ALL YEAR	NATURAL		ABUNDANT	
SEASONAL (SPECIFY →)	SLASH		AVAILABLE	
	OTHER (SPECIFY →)		SCARCE	
			NONE	

(13) FIRE HAZARD ← YES ☐ NO DESCRIBE

FORAGE (14) (SPECIFY TYPE & LOCATION)

ON SITE	OFF SITE	AMOUNT
← YES ☐ NO	← YES ☐ NO	
		ABUNDANT
		AVAILABLE
		SCARCE
		NONE

OTHER RESOURCES (15) (SPECIFY IN COMMENTS SECTION)
1 2 3 4 5

III AREA ATTRACTIONS & OPPORTUNITIES (16)

FIREWOOD CUTTING	FISHING	BERRY PICKING	HUNTING	MUSHROOM COLLECTING	SCENERY	BRUSH PICKING	ROCK COLLECTING	HORSE LOADING RAMP	BOAT RAMP	OTHER												
											4	3	2	1	4	3	2	1	4	3	2	1

OTHER FACILITIES ← (SPECIFY) (17)
1
2
3

	TENS		UNITS		TENS		UNITS		TENS		UNITS		1	HUNDREDS	TENS	UNITS
	2 1	0	7 4 2 1		2 1	0	7 4 2 1		2 1	0	7 4 2 1		2 0'S	7 4 2 1	7 4 2 1	7 4 2 1
X	FOREST CODE				DISTRICT CODE				MGMT. UNIT					SITE NUMBER		

REGION _____ FOREST _____ DISTRICT _____

TOWNSHIP _____ RANGE _____ SECTION _____ DOT [ ] MGMT UNIT _____ SITE NO. _____

DATE CODED CODED BY

GENERAL DESCRIPTION OF SITE	
MANAGEMENT NOTES	
FUTURE MANAGEMENT RECOMMENDATIONS AND SITE COSTS	

KEY #	USE THIS AREA WHEN SPECIFICS ARE REQUIRED OR TO RECORD ADDITIONAL DATA
(23)	ON SITE VEGETATION
(23)	OFF SITE VEGETATION

DEFINITIONS FOR REVISED CODE-A-SITE CARD

(1.) Type of Area - Kept as is under "other" portal, inholding, airfield could be specified.

(2.) Inventory Stage - Stage 1 is the basic Code-A-Site card and thus needs no punch hole.

1. Stage 2 - Documentary and permanent camera point photographic inventory including 360° panorama plus schematic map.

2. Stage 3 - Quantitative Site Impact Inventory and transect schematic map.

(3.) Season of Potential Use - Under remarks record actual observed use based on field observations and resource damage.

1. spring, summer, fall
2. summer
3. fall
4. winter
5. year around

(4.) Trails - If distance to site is greater than $\frac{1}{4}$ mile from mainline or secondary trail use manway, crosscountry or other.

1. Mainline - system trail, serves large area on map, annual maintenance
2. Secondary - system trail, maintenance when possible, serves small area
3. Manway - blazes or tread present, old or abandoned blazed trails, common use routes, historic trail, little or no maintenance, maintenance chiefly limited to route marking
4. Cross-Country - no tread or blazes, no maintenance

5. Other - single user, commercial outfitters, prospectors, trappers

(5.) Distance from Trail - Record actual travel distance from campsite to one of the types of trail listed in section 4 and cardinal direction from camp center to estimated closest point of trail. Purpose is to help others accurately locate camp.

(6.) Type of Site

1. lake
2. stream
3. meadow
4. other - spring, ridgetop

(7.) Tents - As Is

a. tent suitability - mark yes or no, specify why.

1-4. No. of tent spaces - mark number available without additional logging, rocking or brush clearing.

(8.) Types of Access instead of vehicles

a. aircraft (substitute for vehicle suitability)
1. foot
2. horse
3. boat
4. all

(9.) Site Origin - camp history to be written in remarks section

1. official - administrative and special use
2. impromptu - site not established by agency

Current Status

3. unimproved
4. temporary improvements - removed at end of season
5. permanent improvements - year around

(10) Other Sites

a. number in view or hearing - punch appropriate hole, record actual number in shaded area.

b. number with ½ mile - punch appropriate hole, record actual number in shaded area.

(11) Water - specify location, distance, cardinal direction from campsite, dependability.

1. on site - under 200' from edge of site
2. off site - over 200' from edge of site
3. stream
4. spring
5. lake
6. all year
7. seasonal - specify in remarks section

(12) Firewood

Availability

1. on site - less than 200' from edge of site
2. off site - over 200' from edge of site

Source

3. natural - dead limbs, down trees, windfall
4. slash - previously felled trees, bucked up firewood blocks
5. other - standing snags approved for cutting.

Amount on Site

6. abundance - several years supply with heavy use, estimate in cords.
7. available - plentiful but depleted with a couple of years use, estimate in cords.
8. scarce - soon to be exhausted, estimate in cords.
9. none

(13) Fire Hazard - Defined as starting potential. Should consider type and amount of fuel, aspect, slope, etc. If hazardous describe in notes.

a. punch if yes and then describe in notes.

(14) Forage - Following should be recorded in notes:

Type: should include indicator species that indicate changes in quality, condition and trend; identify by per cent of forage species.

Location: distance and cardinal direction from site

Grazing Period: recommended period to minimize site impact

Abundance: size of area, key species composition, plant vigor, production figures, past grazing history

1. on site - within 200' from edge of campsite
2. off site - more than 200' from edge of campsite
3. abundant - can withstand frequent grazing without depletion or damage
4. Available - exists but could be depleted with frequent use
5. Scarce - little forage exists
6. None - no forage available or area identified as vegetative zone to be managed for naturalness

(15) Other Resources (specify in notes)

1. Historic - homesteads, scenes of important events, cabins, trails, lookouts, administrative sites
2. Minerals
3. Archaeological
4. Special use sites
5. - reserved for local use.

(16) Area Attractions & Opportunities - for administrative use not necessarily for public information

1. - reserve for local use instead of firewood cutting
2. Fishing
3. Berry picking
4. Hunting
5. Mushroom collecting
6. - reserve for local use instead of scenery
7. Beach instead of brush picking
8. Rock collecting
9. Flowers - instead of horse loading ramp
10. Rock climbing instead of boat ramp
11. Other
    1. hot springs
    2. wild life
    3. local option
    4. local option

(17) Source of Impact by Mode of Travel - estimate % impact in notes show only impacts <u>that are clearly discernable and can definitely be attributed to mode of travel</u>.

1. horse
2. hiker
3. boater

(18) Toilets - only three categories for toilets

1. none - reserved for use with section 19
2. pit
3. pit structure - (out hourse)
4. sealed vault

(19) Site Carrying Capacity

1. people (1-5) instead of No. Facilities
2. people (6-10) instead of Garbage Cans
3. people (11+ notemaximum) instead of Informational Signs
4. stock (1-5) instead of tables
5. stock (6-10) instead of Fireplace
6. stock (11+ note maximum) this item utilizes "none" space in section 18

(20) Special Management Problems

a. if yes record in notes - should consider such things as wildlife conflicts, facility hazards, archaeological or historical damage.

(21) Impact of Previous Use - Subjective judgement based on ground vegetation impacted, exposed roots, visitor trails, bare areas, dead trees, erosion, vegetation change

1. extreme - previous ground vegetation gone, killed trees, tree roots exposed, erosion present or beginning, compacted soil restricts reestablishment of indigenous vegetation, change in species composition bare soil, little litter, satellite sites may be present.
2. heavy - most previous ground vegetation gone, beginning root exposure, trails radiate from site, erosion absent, litter or duff present, impact restricted to site.
3. moderate - previous ground vegetation relatively intact; absense of tree root exposure, impact limited to immediate site.
4. light - previous ground vegetation intact, but growth somewhat retarded.

(22) Ground Cover - ground vegetation present on the site

1. none
2. 1-25%

3. 26-50%

4. 51-75%

5. 76-100%

(23) Vegetation - narrative goes on back of form at bottom

1. on site - plant community present, habitat type, overstory type, age distribution, 200' from site perimeter

2. off site - same as above, but more than 200' from site perimeter

(24) Crown Cover

1. none

2. 1-25%

3. 26-50%

4. 51-75%

5. 76-100%

(25) Exposure - aspect to which site is generally exposed, use card as is.

(26) Elevation - Specify exact elevation in shaded area, use card as is.

(27) Frequency of Use - describe use variation by season, e.g., infrequent summer use, but constant during hunting season; average pary size observed or gotten from portal records. The percentage figures refer to the per cent of days actually used to the total available days of use. Eventual goal is to come up with numerical number for total use days tied to frequency of use and average party size.

1. constant 75-100%

2. frequent 50-75%

3. moderate 25-50%

4. slight 5-25%

5. infrequent 0-5%

(28) Extra Coding for Local Use - use card as is

"BACK OF CODE-A-SITE CARD"

Most items on this side of the form can best be completed in the office. Special instructions are as follows:

a. Region:	Northern	01
b. Forest:	Bitterroot	03
	Clearwater	05
	Lolo	16
	Nezperce	17
c. Districts	Darby	02
	Lochsa	05
	Missoula	03
	Moose Creek	06
	Powell	06
	Stevensville	01
	West Fork	04

d. Management Unit: *Wilderness Resource Compartment (1-16)

e. Site No. - Use temporary site No. for field identification (IN PENCIL). If more than one individual is doing the inventory work, use initial and No. to avoid confusion later during office coding; e.g., individuals name: Walker, Site #W-12.

f. Legal Description: Indicate Township, Range, and $\frac{1}{4}$ Section (160 acres) of site location. Place dot in box to identify site location in the identified $\frac{1}{4}$ section. e.g., T. 2N., R. 15 W, Sec. SE7 - Dot

$\frac{1}{4}$ Sec.

This identifies a site located in the SWSE of Sec. 7, T. 2N., R. 15 W.

*Wilderness Resource Compartment map in Appendix.

g. Date Coded: Field inventory date

Management Notes: Describe the field situation onsite and relative to resource compartment. Consider: Objectives for Resource Compartment

Priorities

Estimated Time: man and/or pack animal days

Estimated Costs

Trade-offs: What occurs if action not taken or delayed?

Future Management Recommendations: Reserved for District comment: Should address field representative's comments in Management Notes.

FIELD INVENTORY GUIDELINES FOR STAGES 2 & 3

Note: Criteria for Schematic Site Map preparation for Inventory Stages 2 and 3 are identical excepting the linear transect measurements utilized in Stage 3.

II. STAGE TWO: Photographic Inventory

A. Permanent Camera Point Identification and 360° Panorama.

1. Delineate aerial extent of campsite impact. Provides for:

   a. Estimate of site map scale.

   b. Location of "Origin Point".

2. Establish permanent camera point. Ideally this "Origin Point" should provide a good general panoramic view of existing and potential site impacts and be centrally located with respect to the general campsite.

3. Witness the "Origin Point" by three objects. Note distance and true azimuth from the witness objects to the "Origin Point". (Eliminates reciprocal step in reestablishing Origin Point.) If trees are used, identify by Species (PP = ponderosa pine; DF = Douglas fir, etc.), D.B.H. taken from uphill side at 4.5 feet A.G.L. Distance should be taken from estimated center of the tree (pith) to the Origin Point. As site trees are identified during a later inventory step, assign corresponding tree # to witness tree.

4. Center the tripod and level the panorama head and camera over the Origin Point.

5. Take light meter reading of the full 360° area and average, if not too extreme. Place target card on the True North azimuth (360°) from the Origin to identify Photo #1, continue shooting panorama photos in clockwise direction (Hyperfocal focusing will provide maximum depth of field.).

6. A documentary photograph of the "Origin Point" with the tripod in place will aid in its relocation. View should be looking True North unless otherwise noted.

7. Take documentary photographs as needed to supplement the panorama and/or the Site Schematic Map. Include specific resource damage or other features not sufficiently covered by the panorama. The use of the Target Card will provide both a relative viewing scale permit quantitative evaluation later if needed.

B. Site Schematic Map Guidelines Utilizing Field Sheet, RI-2310-4.

1. Site name and number - Use local site name; e.g., Indian Park, Arrowhead Saddle. No number yet except in pencil for personal use when there are two or more camps in same general area.

2. Unit or facility - Use correct Wilderness Resource Compartment Name and Number; e.g., Mussigbrod 08. A permanent individual site number will be designated later in the office to avoid confusion.

3. Date will be the day that the field observation was made.

4. List original photos (rolls and numbers) in "APPROVALS" block.

5. Orientation of Site Schematic Maps - Top of page is North.

6. Provide legal description for site in "Recreation Site Plan - Field Sheet" title block; e.g., SESW, Sec. 21, T. 1 N., R. 16 W.

7. Use scale that will include (if possible) a prominent physiographic or other known feature. If impractical, utilize a reduced scale insert placed in an unused corner of the schematic. When using trails, trail junctions, etc., for reference, use both trail numbers and names to reduce the opportunity for confusion; e.g., The Continental Divide Trail #9.

8. Include all major natural features within visibly impacted area or within that area where restoration or additional site impacts are anticipated; e.g., a Wilderness Restoration Site or a newly designated Special Use Permit Site.

9. Record all trees within the delineated site, beginning at True North and continuing clockwise, by number and species. Note damage (exposed roots, hitch rope girdling, chopping, etc.) by tree No. and D.B.H. on back of Field Inventory Sheet. Suggest shooting Documentary Photograph of damage with target card for perspective.

10. Note all "onsite" cultural features

a. Fire circle diameter; if more than one present, number clockwise.

b. Tent pads, clearing

c. Stock feed and/or hitch areas

d. Latrines

e. Informal trails/purpose

f. Meat racks, equipment caches, etc.

11. Note relationship to nearest major system trail. If offsite, sketch general area map in designated box on Code-A-Site card.

12. Utilize legend to identify symbols when map detail becomes too busy.

III. STAGE THREE: Transect Analysis

A. Complete Site Schematic Map Through Stage Two, Part B.

B. After completing the Panorama Photography, attach the "Transect Disc" to the tripod and orient to True North. (If stage two is deleted, attach "Transect Disc" to stake, via wood screw through the center grommet, and set at "Origin Point".)

1. For each Quadrant Transect (1 through 8) stretch the tape from the Origin Point to the site boundary (point at which visible evidence of site impact ceases).

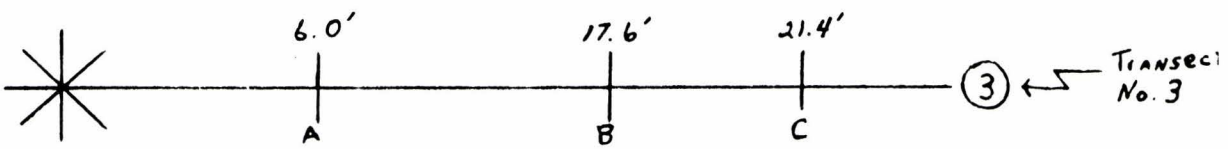
2. Note on the appropriate Transect Line the linear distances comprising each of the following three Data Category Boundaries.

3. Data Categories (these may not be continuous)

   a. Bare - Mineral soil

   b. Denuded - Surface vegetation lacking, duff/litter present.

   c. Trampled Vegetation



To insure accurate site mapping, note distances by Category A, B, or C.

INVENTORY EQUIPMENT NEEDED

STAGE I - Code-A-Site

1. USGS or Planimetric Field Map
2. Compass Corrected for Declination
3. Diameter Tape - 20 Feet

STAGE II - Photographic

1. 2¼" x 2¼" Format Camera
2. Light Meter if not Built In Camera
3. Tripod
4. Panorama Head
5. 6" x 6" White Target Card
6. Field Notebook - "K & E" #820020
7. "Recreation Site Plan--Field Sheet" Form R1-2310-4

STAGE III - Transect Analysis

1. Plastic Transect Disc
2. 50' - 100' (tenths) Fiber Strengthened Tape

APPENDIX MATERIAL

I. Compilation of Field Data - Notebook/Map

II. Field Map Preparation

III. Photo Record Cataloging

IV. Mounting Panorama Photographs for Viewing and Interpretation

V. Suggested Photographic Equipment

APPENDIX MATERIAL

I. Compilation of Field Data - Notebook/Map

Suggest using the K & E Weatherproof Field Book #820020. This 5" x 7" book has coated pages which are more stable in wet weather. Keep a daily diary from the front with the photo record data being recorded from the back toward the front--thus keeping all information relative to the same subject matter under one cover.

A. Example of Photo Record Portion of Diary

ROLL W-61 7-8-70

1 - 10 360° panorama taken from old Maple Lake Lookout benchmark 50mm lens

11 El Capitan from Maple Lake Lookout at 140° 200mm lens

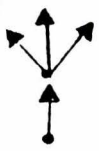
12 Blodgett Mountain from Maple Lake Lookout at 099° 200mm lens looking up East Fork of Moose Creek toward Bitterroot Divide

Note: Duplicates of 11 and 12 shot in color.

When more than one Wilderness Ranger is taking photos, it is suggested that he use his initial before the roll number; e.g., Roll W61 since photographer's name is Walker.

B. General Physiographic Camera Point Identification (Drainage/Mtn. Pk. Panoram

Whenever documentary and/or panorama photographs are taken from a prominent, identifiable point, mark the same on the topographic map with ballpoint

e.g.,  indicating a multiple-shot panorama photo

indicating a single-shot documentary photo

If there is a possibility of confusion in camera point identification, take a photo of the actual camera point identified by a tripod, notebook, etc.,--note the direction of view via azimuth if not looking toward True North.

II. Field Map Preparation

A section of chartex 48" x 34" (trimmed later to approximately 47" x 33") will accept four USGS Topographic Quadrangle sheets, each of which is cut into four equal pieces and then mounted by a hot iron on the chartex with approximately 3/8" space between all edges to permit folding of completed map which will measure when folded 8½" x 12".

In order to reduce time and make the drawing job easier, draw the wilderness, District, and Resource Compartment boundaries on the quadrangle sheets prior to cutting them up for mounting. Use a waterproof ink or waterproof felt pens--otherwise the polymer emulsion will tend to smear them.

The map can then be coated with an acrylic ploymer emulsion (we use LIQUITEX, but any similar product will probably work just as well and is available at most of the larger art and craft shops.) Mix the polymer 50/50 with water and coat the entire map, then hang in dustless area to dry, two or three coats are recommended. Be very certain that final coat is completely dry before folding map--if not, you'll be the possessor of a 3/8" x 8½" x 12" mat which will defy all attempts to unfold. A thorough dusting of talc or foot powder, prior to folding, will preclude map sticking and is highly recommended.

This same mixture of LIQUITEX can also be used as the adhesive agent on muslin if chartex is not available. This last method is the least expensive concerning materials.

This coating is very flexible, waterproof, can can be written on temporarily with grease pencils.

III. Photo Record Cataloging

Contact prints: an 8" x 10" sheet of photo paper having the full roll of negatives printed actual size are used to reference and catalog all inventory photographs.

Note: Each negative on 120 film, like 35mm film, is identified by a margin number, which prints through on the contact print, thus assuring correct negative identification.

The photo data taken from the diary is then transferred to the back of either the actual print or, if both an office and a field copy are desired, the data is typed in duplicate and attached on the contact prints. The latter is recommended.

IV. Mounting Panorama Photographs for Viewing and Interpretation

A. Suggest using the self-adhesive 9" x 12" Dry Mounting Tissue available from GSA, stock # 8040-754-2761, 100 sheets cost approximately $8.

B. Beginning with the panorama photograph documenting True North (#1), lay out the photos comprising the panorama left to right. Determine the maximum length of individual panorama sections by where the panoramas will be filed; e.g., special use folder limits section length to 11", thus you will need two sections of dry mount tissue to complete the

eight-photo panorama when using the 55mm lens 2¼ x 2¼--or if using a Rollei camera with the normal 80mm lens, a 360° panorama will require 12 photos and take three sections of dry mount tissue.

C. When trimming the adjoining photos to mount,

it is important to split the area of overlap equally between two photos (especially true when using wide angle 55mm lens due to convergence near the edge).

Cut the right edge of first photo using razor blade or sharp knife and metal straight edge. Place first trimmed photo over second photo to obtain proper coverage. Mark second photo and trim to match with straight edge. Continue with all the photos.

D. After all photos are properly trimmed, starting with the left most photo, place on exposed dry mount tissue. Align the edge of the next photo to assure correct matching, holding the photo at approximately 30° angle to the tissue. Assure the attachment of the photo to the tissue by placing the removed section over the photo and press.

E. After panorama is mounted, identify each section (left A, next B, etc.), plus date, Resource Compartment, site, lens and photographer.

V. Suggested Photographic Equipment

A. Cameras

Cameras offering at least a 2¼ x 2¼ negative (120 film) should be given strong consideration for the following reasons:

1. Negatives for RO and/or WO photo file must be this size or larger.

2. Square format provides greater vertical coverage and in a panorama will usually fully cover a camp, etc., taken on a sloping site.

Rollei twin lens reflex cameras can be used. However, since they usually have a 80mm (normal) lens, it will require 12 photos to complete a panorama.

The Mamiya C220 twin lens reflex camera using the optional 55mm f4.5 lens (wide angle) completes the panorama with eight photos.

This camera also accepts 80mm, 180mm and 250mm interchangeable lenses.

Yashica twin lens reflex camera "Model D w/o lightmeter"; "Model MAT-124G built in lightmeter" both have 80mm normal lens.

Note: The wide angle lens has an inherently greater depth of field.

B. Linhof Nu-Line Model 1 Tripod

Weight 3.75 pounds - has a built-in spirit level. I don't believe this is available through GSA.

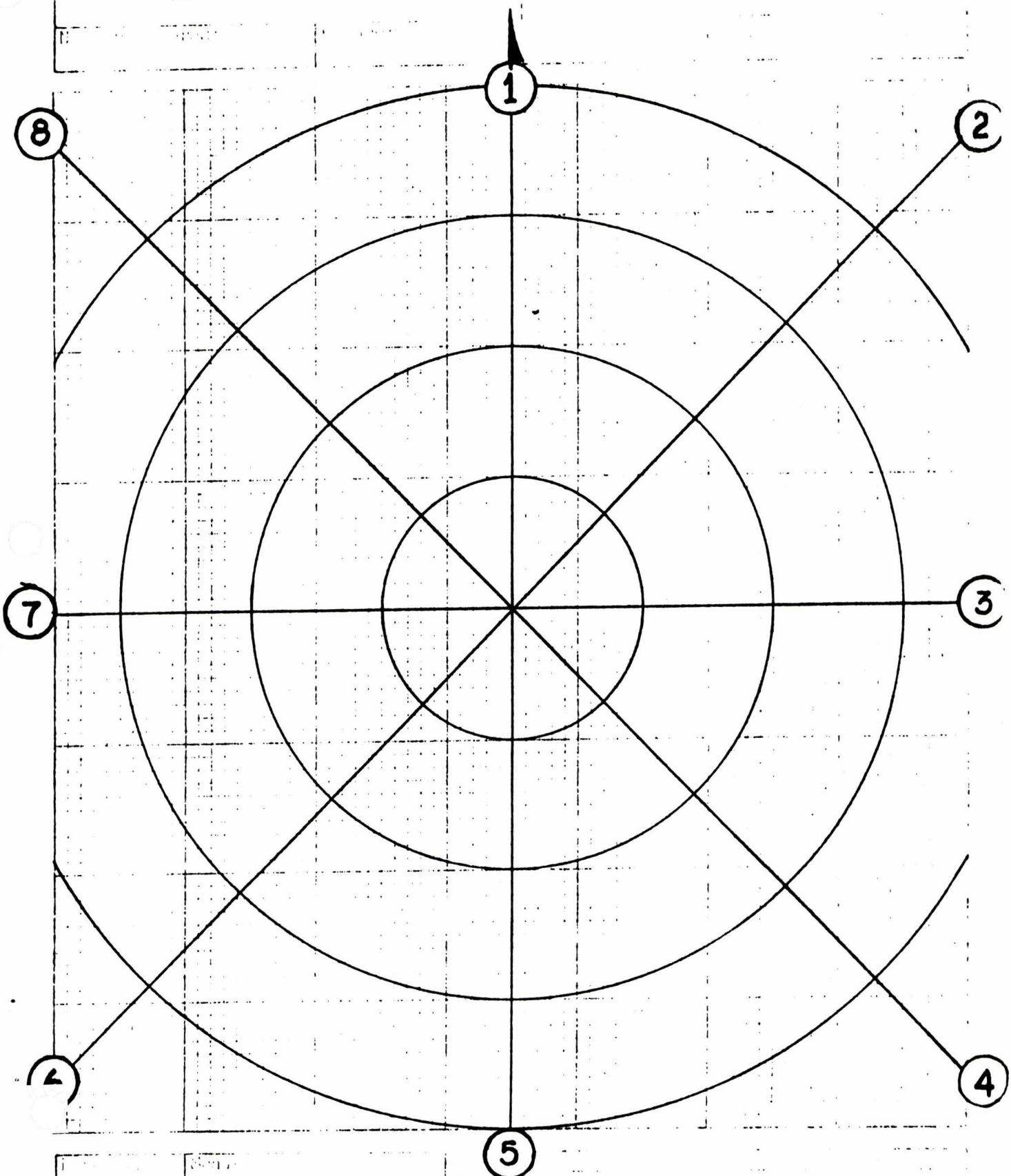
If a tripod having an accurate spirit level is not available, another tripod may be substituted by utilizing a panorama head, such as the one manufactured by Rollei or Nikon.

C. Weston Master V Light Meter

D. Cable Release - For taking either low shutter speed or time exposures.

E. Self-Timer - Enabling the photographer to be in the photograph, thus providing perspective when needed.

F. Tupperware Container - Large bread loaf size--lined with ¼-inch ensolite material which provides insulation and padding for the camera, light meter and film. This container, when tied with a thong, is also waterproof unless hit hard enough to pop open the top.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TRAIL EVALUATION WORKSHEET

APPENDIX Pages 113 to 119

This is the interim inventory and classification form developed by Region One until National Trail Assessment forms are finally adopted. Instructions for filling out the form and identifying the experience levels are included here. National trail assessment procedures will be adopted when they are completed.

TRAIL EVALUATION WORKSHEET

Inventory & Classification (Present Situation)

Forest _____ By _____ Date _____

Trail Name _____ Total Miles _____

Sections Inventoried This Sheet:

No.	Miles	District	County	Termini

SERVICE LIFE (Check One)

Basic _____
Interim _____
Short Term _____

Notes: _____

USER EXPERIENCE TYPE (Check One)

Access: Mainline _____ Secondary _____ Primitive Route _____

Special Recreation Type _____ (Kind _____)

ZONING (Present Situation - Check One or Two)

Unrestricted _____ Hikers Only _____
Non-motorized: Summer _____ Winter _____ Yearlong _____

USE (Number 3 by Use Volume)

Day Hiker _____
Backpacker _____
Pack/Saddle _____
Motorized _____
Bicycle _____
Handicapped _____
Other (_____) _____

USE VOLUME (Check One)

Light - 30 per season _____
Medium - 30-300 _____
Heavy - 300-1,000 _____
Extra Heavy - 1,500+ _____
Note: _____

EXPERIENCE LEVEL (WO Criteria - Check One)

I _____ II _____ III _____ IV _____ V _____

MAINTENANCE RESPONSIBILITY

F.S. _____ Other (Who?) _____

RIGHT-OF-WAY NEEDS: Miles _____ No. Cases _____

AREA SERVED: Wilderness/Primitive (Name) _____

Rec. Site (Name) _____ Other Classified (Name) _____
General Undeveloped _____ Other _____
New Study Area _____ National Scenic Trail Segment _____
National Recreation Trail System _____

Form 7700-9T Updated: By _____ Date _____

TRAIL ASSESSMENT PROCESS

The trail assessment will include only trails identifiable on the ground yearlong and excludes stock driveways. Snowmobile and cross-country ski trails will be assessed separately.

INSTRUCTIONS FOR WORKSHEET 1

Inventory

1. Start with present trail inventory (7700-9T) on a current map. Identify other existing trails from travel plans, existing knowledge, and public input.

2. Delete trails from inventory that no longer are in existence.

3. Travelways used by vehicles over 40 inches in width, i.e., jeep roads, are not trails and should be inventoried as roads. Forest travel planning surfaced numerous travelways in this category.

Classification

Use Worksheet 1 to inventory and classify trails by management objectives. The classification should be by the present situation.

Separate worksheets will be needed for sections of trail with differing objectives; e.g., trail 9: (1) Sections 9.1 and 9.2 in wilderness, (2) Section 9.3 restricted to nonmotorized traffic, and (3) Section 9.4 unrestricted. The assessment process may result in revisions of the sections as inventoried in the 7700-9T trail inventory.

1. Service Life

   a. Long-Term Trails (constant service)

      (1) Basic Trails. Basic trails are defined as pathways planned for continuous future use and are essentially on the proper location to serve that use.

      (2) Interim Trails. Trails which are likely to be replaced in the future (5-15 years) by: (a) another transportation facility; (b) trails (or segments) not on proper location to meet future planned use but used now under special management controls to avoid resource damage, or (c) trails on land planned for land exchange and where they will likely be obliterated or abandoned by the future owners.

b. Short-Term Trails - Sections of trail or pathways with unresolvable resource or safety problems or otherwise not needed for management. Trails in this category are retained on the inventory record but planned for inactivation by obscuring entrance after performing necessary drainage protection work. When these trails have been obliterated by natural or other means they are removed from inventory records.

2. User Experience Type - Trail use is classified by management into the following types:

a. Access Type - The management objective for this type of use is primarily to provide for access to land areas or specific destinations for the Selway-Bitterroot; Trunk = Mainline; Limited Purpose = Secondary; Primitive = Primitive.

(1) Trunk - Primary Access. Users expect unimpeded, convenient travel into forest areas. They expect a reliable, consistent design and safe for a wide range of skills by the user group.

(2) Primitive or Limited Purpose - Users of these trails expect trails that match the skill level as advertised, marked or otherwise permitted by management. Trail hazards normal to this user group are expected. Users expect interruption of service from lower maintenance cycles, temporary restrictions during periods of unstable treads or high water.

b. Special Recreation Type - The management objective is to provide a specified recreation experience. The trail itself often is the attraction. This may lead to many varieties of trails such as nature walkways, outdoor education facilities, bridal loop trails, etc. Selected trails for testing motorbike skills in off-road vehicle plans might be included here. (FSM 2353 will include further breakdowns of these trail types).

3. Zoning - Check current travel plan designation.

4. Use - List three predominant uses in order; e.g., backpacker 1, pack/saddle, 2 and day hiker, 3.

5. Use Volume - Check estimate of current seasonal traffic volume; i.e., number of users.

6. Experience Level - Classify by WO criteria (refer to Figure III) based on presently perceived experience level. In the future, the recreation experience level will be a guiding criterion for determining suitable trail location, design, and maintenance standards.

7. Maintenance Responsibility - If other than Forest Service, list name of responsible entity.

8. Rights-of-Way - List miles of right-of-way and number of cases where rights-of-way have not been obtained.

9. Area Served - Write in name of special area, new study area, or developed site served; if general undeveloped indicate by a check.

EXPERIENCE LEVELS - TRAIL MANAGEMENT

Goal	Objectives and Considerations		Mode of Travel	Density	Design and Management Criteria		
	System Environment	Resource Environment			Design & Construction Criteria	Maintenance Objectives	Control Techniques
Level I (Primitive)	a) Preserve opportunities for challange, solitude & physical achievement. b) Users will possess a high degree of basic skills c) Minimize noise d) Maximize close to nature feeling e) No mechanized access.	Visual-preservation soil-some disturbance by use and from min. construction water-maintain high qual. air-high quality wildlife-allow no stress & avoid key areas.	a) Ski b) Hike c) Horse d) Snowshoe	a) Low volume b) High degree of separation: 1. People 2. Parties 3. Hikers & Horses	a) Construct some tread to protect resource values & improve poor location. b. Emphasize use of existing trails rather than new construction. c) Utilize native material & blend trail with landscape.	Level 2	a) Sign to minimum necessary for resource protection. b) Use maps & brochures. c) Implement permit system d) Use other techniques to locate trail other than blazing trees. e) Separate trails for different modes of travel. f)No signs for winter use.
Level II	a) Preserve a moderate degree of opportunity for challenge & solitude b) Users will possess a moderate degree of outdoor skills. c) Utilize minimum on site control for resource protection & user safety. d) Minimize noise e) Limited motorized acces. f) Feeling of being close to nature.	Visual-preservation soil-disturbance by construction water - maintain quality air - high quality wildlife-avoid key areas. flora - natural process.	a) Ski b) Hike c) Horse d) Snowshoe e) Trail bike f) Snowmobile	a) Low to medium volume b) Moderate degree of separation.	a) In addition to Level I provide trail tread for user safety. b) Limit access when stream crossings are unsafe. c) Use native material where possible.	Level 2	a) Some directional signing. b) Use guide signs & markers. c) Some control signs to regulate types of use, season opening & trail conditions. d) Mark winter ski & snowmobile trails, indicate trail bends.

EXPERIENCE LEVELS - TRAIL MANAGEMENT

Goal	Objectives and Considerations		Mode of Travel	Density	Design and Management Criteria		Control Techniques
	System Environment	Resource Environment			Design & Construction Criteria	Maintenance Objectives	
vel III	a) Preserve some opportunity for challenge & solitude b) Moderate degree of skill is necessary c) Moderate control of safety, comfort & convenience d) Feeling of being close to nature	visual-partial retention soil-disturbed by construction water-maintain quality air-high quality wildlife-avoid key areas flora- except change	a) Ski b) Hike c) horse d) Snowshoe e) Trail Bike f) Snowmobile	a) Medium to heavy volumes of use & numbers of encounters. b) low degree of separation between non-motorized users. c) High degree of separation between motorized users.	a) In addition to Level II provide trail tread for user convenience. b) Stress permanence c) Clear for winter	Level 2	a) Use directional signs, well signed trails b) Control signs for separate modes of travel.
vel IV	a) High degree of social contact b) Control for safety comfort & conv ience c) Some isolation possible d) Minimum challenge	visual - maximum modification soil - disturbed by construction water-maintain qualify air-moderate quality wildlife-through key areas with seasonal control. flora-except change	a) Ski b) Hike c) Horse d) Snowshoe e) Trail bike f) Snowmobile	Heavy volume of use & encounters	a) In addition to level I, II, & III requirements, provide more stable trend & avoid user controls. b) Use special safety features c) Use special trends to provide for special vehicles & spread types of travel.	Level 3	a) High degree of control is visable b) Use directional & control signs c) Interpretive signs used d) Winter control techniques

EXPERIENCE LEVELS - TRAIL MANAGEMENT

Goal	Objectives and Considerations		Mode of Travel	Density	Design and Management Criteria		Control Techniques
	System Environment	Resource Environment			Design & Construction Criteria	Maintenance Objectives	
Level V	a) Minimum skill necessary b) Feeling of being next to nature c) Control obvious to user	Visual-Maximum modification soil-Disturbance by construction water-maintain quality air-moderate quality wildlife-through key areas with seasonal control flora-except change	a) Ski b) Hike c) Horse d) Snowshoe e) Trail bike f) Showshoe g) Bicycle	Heavy volume of use & encounters	a) Normally praticed around recreation complexes b) Provision made for all types of users.	Level 3	a) All technique employed.

Note: Maintenance Levels

Level 1 - Trail is maintained to a level to provide for protection of resources.

Level 2 - Trail is maintained to a level for the protection of the trail.

Level 3 - Trail is maintained to provide for user convenience.

INVENTORY OF THE FORAGE RESOURCE

APPENDIX Pages 121 to 125

These are the standard procedures and forms developed by the task force and adopted by the Rangers for inventory of the forage resource in the Selway-Bitterroot. Field training of wilderness rangers in this procedure was completed in 1978. Continued training of new employees will be necessary.

SELWAY-BITTERROOT WILDERNESS CARRYING CAPACITY STUDY

INVENTORY OF THE FORAGE RESOURCE

The determination of the carrying capacity of forage areas can be a very difficult task, even on intensively managed range allotments. This determination is even more complicated in the Selway-Bitterroot Wilderness because of the following:

1. The area contains many diverse vegetation conditions due to variations in elevation, topography, and precipitation.

2. The forage resource must retain a natural appearance and be "substantially unmodified by man". Wildlife has been given priority for utilization of the forage over domestic livestock.

3. Many forage areas are being invaded by conifers as a result of efficient fire control activities during the past 50 years.

4. High subalpine meadows depend heavily on rainfall during June and July. Forage production on some of the meadows has been found to vary more than 300 percent from one season to the next.

5. Very little information is available concerning the affect past grazing has had on forage plants and soils within the area.

6. Many Wilderness Rangers lack the technical training necessary to adequately inventory and evaluate the forage resource.

7. Forage is only one of many resources the Wilderness Ranger must inventory to arrive at the total carrying capacity. Intensive analysis will not be possible at this time due to the large size of the area and the constraints of manpower and financing.

With these thoughts in mind, the attached Selway-Bitterroot Wilderness Forage Inventory sheet was developed for use by the Wilderness Ranger and his assistants for collecting and recording information concerning the forage resource. The sheet can be used to record information already on file, as well as new information collected in the field.

Procedure for Use:

1. The Wilderness Ranger should inventory the forage resource in conjunction with the Code-A-Site Inventory or as assigned. A portion of the forage information should be recorded in Block 14 of the Code-A-Site Card.

2. Procedures outlines in the Range Environmental Analysis Handbook (FSH 2209.21R1) should be reviewed and followed.

3. Part I and III of the Selway-Bitterroot Wilderness Forage Inventory can be completed by the Wilderness Ranger after being trained. Part II should be completed by technically trained range technicians. Wilderness Rangers may gather information for Part II after being trained.

4. Before going to the field, summarize any information already on file on the inventory sheet. Field mapping may be done on frosted acetate overlays or directly on the aerial photographs. Number the individual forage areas. Final range maps should be prepared on a 2" to the mile or larger base map.

5. Use the standard range color codes for mapping vegetation types and recording photo points.

6. Prepare a sketch map of each forage area including information concerning location, size, and vegetation type.

7. Take photographs showing typical views of the vegetation (closeup shots) and general aspect (distant shots) of the forage area. Record the location of the photo points on the aerial photo overlay and sketch map.

SELWAY-BITTERROOT WILDERNESS FORAGE INVENTORY
(Reference FSH 2209.21R-1)

Forest		Date	
District		Drainage or Area	
Packstock Allotment	Management Unit No.	Location	
Aerial Photo No.	Elevation	Slope	Exposure

PART I

1. DESCRIPTION OF FORAGE AREA

a. General Vegetation Type

/ / Mountain Grassland (bunchgrass)
/ / Meadow (includes bluegrass)
/ / Mountain Shrubland
/ / Perennial Forb
/ / Conifer
/ / Broad Leaf Tree
/ / High Elevation Grassland

b. Size _____ Total Acres
Describe method of measurement:

c. Percentage of Area Suitable for Recreation Livestock Grazing
(delete bogs, rock outcrops, slopes over 50%, etc.)

_____ Percent of Total Acres

d. Evidence of Use by Big Game
(elk, deer, moose, bighorn sheep, mountain goat, etc.)

e. Density of Ground Cover (percent)

/ / Grass
/ / Sedge
/ / Forbs
/ / Shrubs
/ / Moss
/ / Bare Soil
/ / Erosion Pavement
/ / Rock
/ / Litter
/100/ Total

Describe method of measurement:

INSTRUCTIONS: Part I and III of this form can be completed by a trained Wilderness Ranger or his assistant. Part II should be completed by personnel with technical range training.

PART II

1. DESCRIPTION OF FORAGE

a. Range Condition and Trend

Vegetative Condition	Vegetative Trend
/__/ Excellent	/__/ Up
/__/ Good	/__/ Down
/__/ Fair	/__/ None Apparent
/__/ Poor	/__/ Uncertain
/__/ Very Poor	

Describe method of measurement:

b. Forage Production

_____lbs. per acre (air dry weight)

Method of Measurement:

/__/ Ocular Estimate by plot

/__/ Actual Weight from .96 square foot clipped plots

c. Forage Utilization

_____Percent (air dry weight)

Method of Measurement

/__/ Ocular Estimate by plot

/__/ Grazed Plant Method

/__/ Grazed Loop Method

/__/ Actual Weight from Clipped Plots

d. Range Readiness (estimate date area ready for grazing in average year.)

PART III

1. DISCUSSION OF PROBLEMS AREAS

   a. Notes on Soil

   b. Notes on Vegetation

   c. Special Problems (Ex: Trampling, Streambank damage, Tie Tree Damage, Salt Grounds, etc.)

   d. Photographs (Describe photographs taken of forage area and attach them on a separate sheet.)

2. Forest Area Map

   (Sketch forage area here or attach aerial photo, aerial photo overlay or 2"/mile or larger scale map. Include name of general area, legal description, scale, north arrow and general vegetation type.)

Color Code:

Mountain and/or high elevation Grassland (yellow)	
Meadow (orange)	Unsuitable (black)
Perennial Forb (red)	Rock or Barren (gray)
Browse-Mountain Shrub (olive green)	Broad Leaf Trees (pink)
Conifer (dark green)	Water or Bog (blue)